JCM-350-E01/E02

Controller with I/O module

User Manual

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Assignment to product

This user manual is an integral part of JCM-350-E01/E02:

Type: _____

Serial #: _____

Year of manufacture: _____

Order #: _____

CE

To be entered by the customer:

Inventory #: _____

Place of operation: _____

Significance of this user manual

This document is an integral part of the JCM-350-E01/E02:

- Keep this document in a way that it is always at hand until the JCM-350-E01/E02 will be disposed of.
- Pass this document on, if the JCM-350-E01/E02 is sold or loaned/leased out.

In any case you encounter difficulties to clearly understand this document, please contact Jetter AG.

Jetter AG would appreciate any suggestions and contributions on your part and would ask you to contact Jetter AG at the following e-mail address: info@jetter.de. This will help the documentation department produce documents that are more user-friendly, as well as address your wishes and requirements.

This document contains important information on the following topics:

- Transport
- Mounting
- Installation
- Programming
- Operation
- Maintenance
- Repair

Therefore, the user must carefully read, understand and observe this document and especially the safety instructions.

In the case of missing or inadequate knowledge of this document, Jetter AG shall be exempted from any liability. Therefore, the operating company is recommended to obtain the persons' confirmation in writing that they have read and understood this document.

Hazard levels

Introduction

This topic describes the safety labels and hazard levels used in this manual.

Safety labels

Signs using this symbol are to warn you of injuries or even death. Follow the instructions given in the corresponding topic to prevent hazards.

Hazard levels

Safety information is classified into the following hazard levels:

Hazard level	Consequences	Probability
DANGER	Death/severe injury (irreversible)	The hazard is imminent.
WARNING	Death/severe injury (irreversible)	Potential occurrence
CAUTION	Slight injury (reversible)	Potential occurrence
CAUTION	Material damage	Potential occurrence

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1 Safety Instructions

Introduction

This chapter informs the user of fundamental safety instructions. It also warns the user of residual dangers, if applicable.

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Basic safety instructions

Introduction

This device complies with the valid safety regulations and standards. Jetter AG attaches great importance to the safety of the users.

Of course, the user should adhere to the following regulations:

- Relevant accident prevention regulations;
- Accepted safety rules;
- EC guidelines and other country-specific regulations

Intended conditions of use

Usage according to the intended conditions of use implies operation in accordance with this user manual.

This device has been designed as a controller for use in commercial vehicles and mobile machines, such as

- Road sweepers
- Fire-fighting vehicles
- Harvesting machines
- Construction machines

The controller JCM-350-E01/E02 meets the requirements of the European Automotive EMC Directive for electric/electronic subassemblies. The controller JCM-350-E01/E02 is intended for installation in a mobile machine.

Operate the controller JCM-350-E01/E02 only within the limits and conditions set forth in the technical specifications. The operating voltage of the controller JCM-350-E01/E02 is classified as SELV (Safety Extra Low Voltage). Therefore, the JCM-350-E01/E02 controller is not subject to the EU Low Voltage Directive.

Usage other than intended

This device must not be used in technical systems which to a high degree have to be fail-safe, e. g. ropeways and aeroplanes.

The JCM-350-E01/E02 is no safety-related part as per Machinery Directive 2006/42/EC. This device is not qualified for safety-relevant applications and must, therefore, NOT be used to protect persons.

If you intend to operate the device at ambient conditions not being in conformity with the permitted operating conditions, please contact Jetter AG beforehand.

Personnel qualification

Depending on the life cycle of the product, the persons involved must possess different qualifications. The following requirements must be met, in order to grant safety in handling the device in each phase of the product life cycle.

Product Life Cycle	Minimum Qualification
Transport/Storage:	Trained and instructed personnel with knowledge in handling electrostatically sensitive components.
Mounting/Installation:	Specialized personnel with training in electrical/automotive engineering, such as automotive mechatronics fitters.

Product Life Cycle	Minimum Qualification
Commissioning/ Programming:	Trained and instructed experts with profound knowledge of, and experience with, automotive / automation technology, such as automotive engineers for mobile machinery.
Operation:	Trained, instructed and assigned personnel with knowledge in operating electronic devices for mobile machinery.
Decommissioning/ Disposal:	Specialized personnel with training in electrical/automotive engineering, such as automotive mechatronics fitters.

Modifications and alterations to the module

For safety reasons, no modifications and changes to the device and its functions are permitted.

Any modifications to the device not expressly authorized by Jetter AG will result in a loss of any liability claims to Jetter AG.

The original parts are specifically designed for the device. Parts and equipment from other manufacturers are not tested, and therefore not released by Jetter AG.

The installation of such parts may impair the safety and the proper functioning of the device.

Any liability on the part of Jetter AG for any damages resulting from the use of non-original parts and equipment is excluded.

Handling

The JCM-350-E01/E02 contains electrostatically sensitive components which can be damaged if not handled properly.

To exclude damages to the JCM-350-E01/E02 during transport it must be shipped in its original packaging or in packaging protecting against electrostatic discharge.

- Use an appropriate outer packaging to protect the JCM-350-E01/E02 against impact or shock.
- In case of damaged packaging inspect the device for any visible damage. Inform your freight forwarder and Jetter AG.

Storing

When storing the JCM-350-E01/E02 observe the environmental conditions given in the technical specification.

Repair and maintenance

The operator is not allowed to repair the device. The device does not contain any parts that could be repaired by the operator.

If the device needs repairing, please send it to Jetter AG.

Disposal

When disposing of the device, the local environmental regulations must be complied with.

Residual dangers and protective measures

Residual dangers

Consider the residual dangers mentioned in this chapter when assessing the risks associated with your machine.

DANGER

Hazard in explosive gas atmosphere!

This device can become a source of ignition in potentially explosive atmospheres.

➢ **Do not use this device in potentially explosive atmospheres.**

WARNING

Hot surface hazard!

The JCM-350-E01/E02 can heat up during operation. During operation the surface temperature of this device will become hot enough (> 60 ℃) to cause burns.

➢ **Take protective measures to prevent inadvertent contact with the device, e.g. install protective covers.**

➢ Allow the device to cool down for some time before you start working on it, e.g. to carry out maintenance jobs.

CAUTION

Possible occurrence of malfunctions!

CAN wires which have not been twisted may increase susceptibility to noise. This may disturb communications with the device which, in turn, may cause malfunctions.

➢ Make sure that twisted pair cables are used for connecting the CAN interfaces.

2 Product description and equipment configuration

Introduction

This chapter covers the design of the device, as well as how the order reference is made up including all options.

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JCM-350-E01/E02 - Product description and design

Controller JCM-350-E01/E02

The JCM-350-E01/E02 is a controller equipped with a built-in I/O module and has been designed for use in the harsh environment of trucks. The controller JCM-350-E01/E02 is available in two models:

- The controller JCM-350-E01 is equipped with one built-in I/O module.
- The controller JCM-350-E02 is equipped with two built-in I/O modules.

Product features - JCM-350-E01

The features of the controller JCM-350-E01 are listed below:

- 4 analog inputs, 12 bits, configurable
  - 0 V ... +10 V
  - 0 V ... +32 V
  - 0 mA ... 20 mA
  - 4 mA ... 20 mA
- Ratiometric voltage measurement (related to operating voltage)
- 11 digital active-high/active-low inputs, configurable
- 4 digital frequency inputs
- 8 PWM outputs
- 4 analog outputs
- 8 digital PNP outputs
- 2 H-bridges
- 2 relay contacts 15 A
- 2 relay contacts 2 A
- 5 CAN-2.0B interfaces;
  CAN1: CANopen® device,
  CAN2 ... CAN5: J1939 or CANopen® device selectable
- 8 function keys with LED
- 3 mode LEDs (RUN/CONFIG/TEACH)
- RAM memory: 32 KB (remanent)
- Flash memory: 128 MB
- System memory: 256 MB

Product features - JCM-350-E02

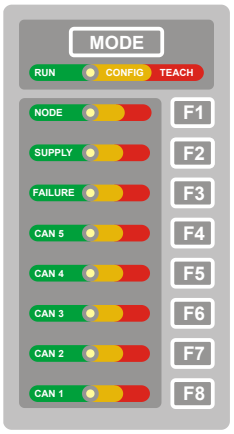
The features of the controller JCM-350-E02 are listed below:

- 8 analog inputs, 12 bits, configurable
  - 0 V ... +10 V
  - 0 V ... +32 V
  - 0 mA ... 20 mA
  - 4 mA ... 20 mA
- Ratiometric voltage measurement (related to operating voltage)
- 22 digital active-high/active-low inputs, configurable
- 8 digital frequency inputs
- 16 PWM outputs
- 8 analog outputs
- 16 digital PNP outputs
- 4 H-bridges
- 4 relay contacts 15 A
- 4 relay contacts 2 A
- 5 CAN-2.0B interfaces;
  CAN1: CANopen® device,
  CAN2 ... CAN5: J1939 or CANopen® device selectable
- 8 function keys with LED
- 3 mode LEDs (RUN/CONFIG/TEACH)
- 32 KB RAM (remanent)
- Flash memory: 128 MB
- System memory: 256 MB

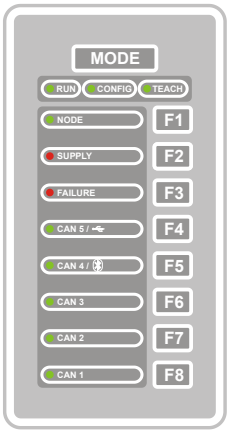
Different operator panel designs

The JCM-350-E01/E02 is available in two different operator panel designs. The functionality is not affected by the different designs.

1



2



Number	Description
1	The mode LEDs are dual-color LEDs (red/green)
2	The status LEDs are single-colored. Status LEDs **"Supply"** and **"Failure"** are red, the other status LEDs are green.

Parts and interfaces

Introduction

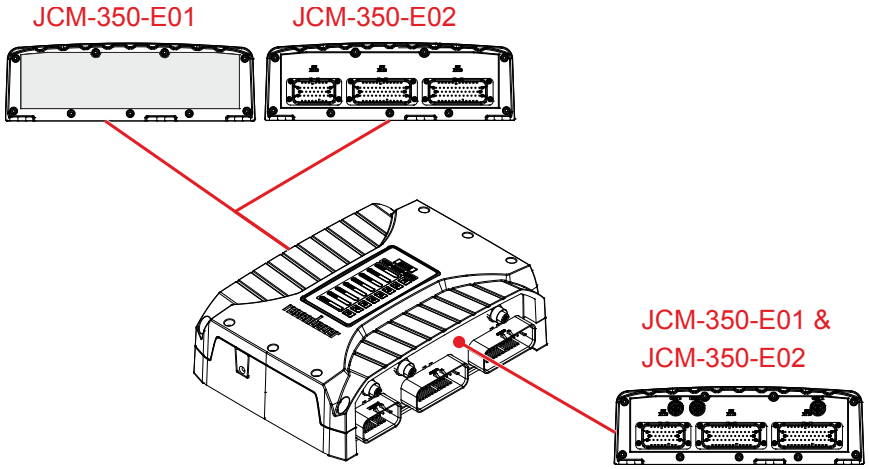
This chapter describes the parts and interfaces of the JCM-350-E01/E02.

Models - overview

The following JCM-350 models are available:

- JCM-350-E01 - controller with one built-in I/O module
- JCM-350-E01 - controller with two built-in I/O modules

The illustration below shows the two models:

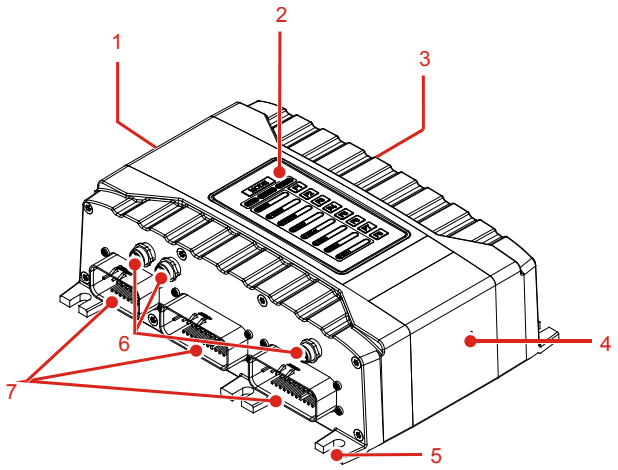


One side wall of the JCM-350-E01 is provided with three connectors for connecting peripheral devices. The opposite side wall is not equipped with connectors.

The JCM-350-E02 is provided with three connectors on each side wall.

Parts and interfaces

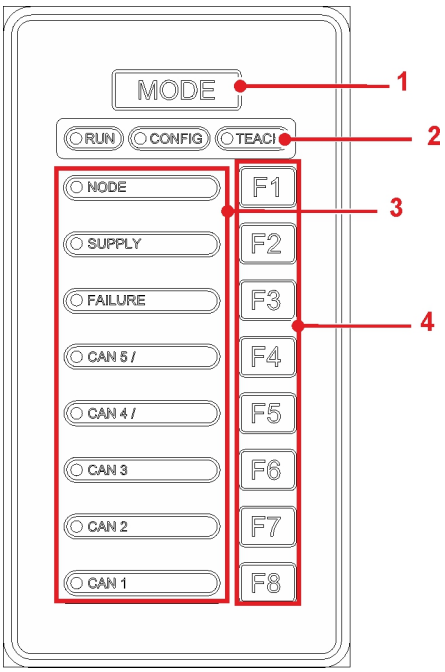
The JCM-350-E01/E02 features the following parts and interfaces:



Number	Element	Description
1	Nameplate	Lets you identify the JCM-350-E01/E02
2	Operator panel	Lets you directly operate the controller
3	X210, X218 and X219	Only with JCM-350-E02: Lets you connect additional peripherals and power supply
4	Pressure compensation membrane	Compensation of inside and outside air pressure
5	6 fastening lugs	For screwing down the JCM-350-E01/E02
6	CAN interface	Allows communication with other CAN devices
7	X110, X118 and X119	Lets you connect additional peripherals and power supply

Operator panel

The operator panel lets you access the controller JCM-350 to set, for example, its node ID.



Number	Element	Description
1	Mode	Function key for configuring the controller
2	Mode LED	Indicates the mode (RUN, CONFIG and TEACH)
3	Status LED	Indicates the controller condition
4	F1 through F8	Function keys for triggering certain controller functions.

Order Reference / Options

Order Reference

The JCM-350-E01/E02 is available in the following configurations. To order a specific module from Jetter AG please specify the corresponding item number.

Item #	Produktname	Description
10000900	JCM-350-E01-G05-K00	Controller equipped with one I/O module (3 AMPSEAL connectors for peripherals)
10000901	JCM-350-E02-G05-K00	Controller equipped with two I/O modules (6 AMPSEAL connectors for peripherals)
10000953	JCM-350-E01-G12-K00	Controller equipped with one I/O module (3 AMPSEAL connectors for peripherals)
10000954	JCM-350-E02-G12-K00	Controller equipped with two I/O modules (6 AMPSEAL connectors for peripherals)

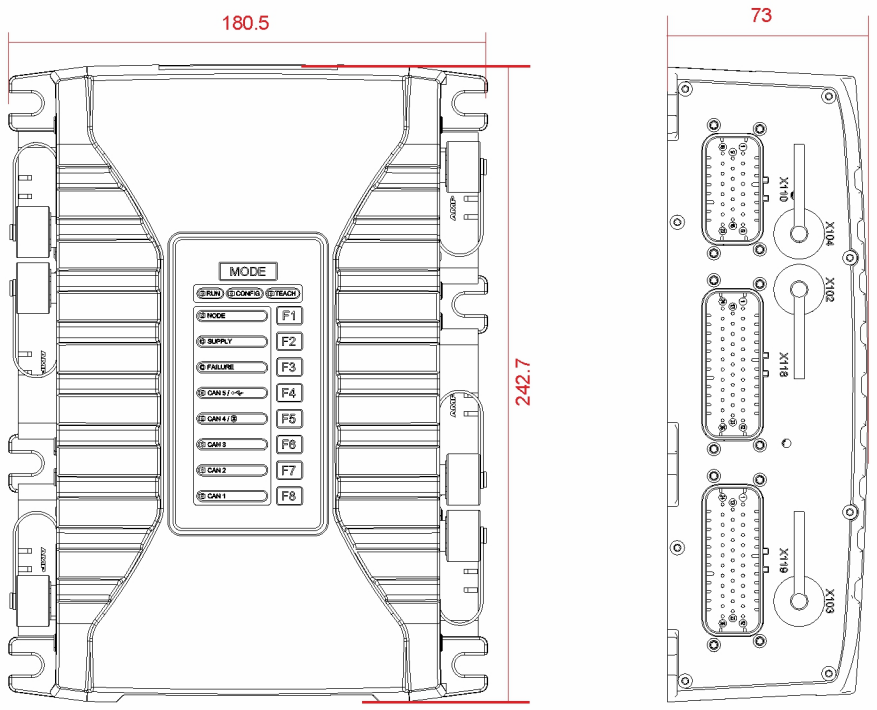
Physical dimensions

Introduction

This chapter details the physical dimensions of the JCM-350-E01/E02 and the conditions for its installation. This device is available from Jetter AG in two different housing designs: G05 or G12.

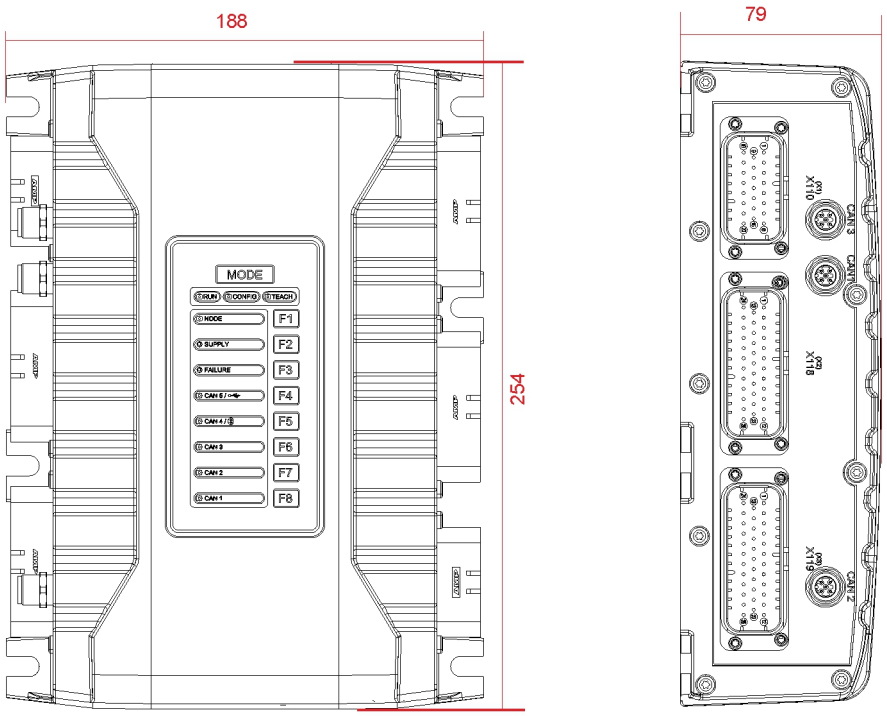
Model G05

The illustration below shows the dimensions of the model G05:



Model G12

The illustration below shows the dimensions of the model G12:



Protection against overheating

When you select a place for installing the JCM-350-E01/E02, consider the following facts:

- The JCM-350-E01/E02 increases the temperature of the environment as a result of heat emission under load.
- The JCM-350-E01/E02 design enables excess heat to be dissipated via base plate. Ensure an unobstructed heat conduction.

Consider the heat emission from the JCM-350-E01/E02, in particular when installing it in a critical environment:

- In the vicinity of the fuel tank
- In the vicinity of the fuel pipe
- In the vicinity of flammable vehicle components
- In the vicinity of thermally malleable vehicle components

Space required for installation and service

When you select a place for installing the JCM-350-E01/E02, consider the following facts:

- Ensure there is enough space around the connector for servicing requirements. It should be possible to disconnect the connector at any time.
- Ensure there is enough space around the operator interface for servicing requirements. The operator interface must be visible and accessible.

3 Identifying the Controller

Purpose of this chapter

This chapter is for supporting you in identifying the following information with regard to JCM-350-E01/E02:

- Determining the hardware revision.
- Determining the OS version of the controller and its software components.
- Retrieving Electronic Data Sheet (EDS) information. Numerous production-relevant data are permanently stored in the EDS.

Prerequisites

To be able to identify the JCM-350-E01/E02 controller, the following prerequisites must be fulfilled:

- The controller is connected to a PC.
- The programming tool JetSym 4.3 or higher is installed on the PC (earlier versions do not support STX).

Information for hotline requests

If you wish to contact the hotline of Jetter AG in case of a problem, please have the following information on the JCM-350-E01/E02 controller ready:

- Serial number
- OS version number of the controller
- Hardware revision

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3.1 Identification by means of the nameplate

Introduction

The nameplate is attached to the housing of the JCM-350-E01/E02 and contains details, such as hardware revision number and serial number. If you wish to contact the hotline of Jetter AG in case of a problem, please have this information ready.

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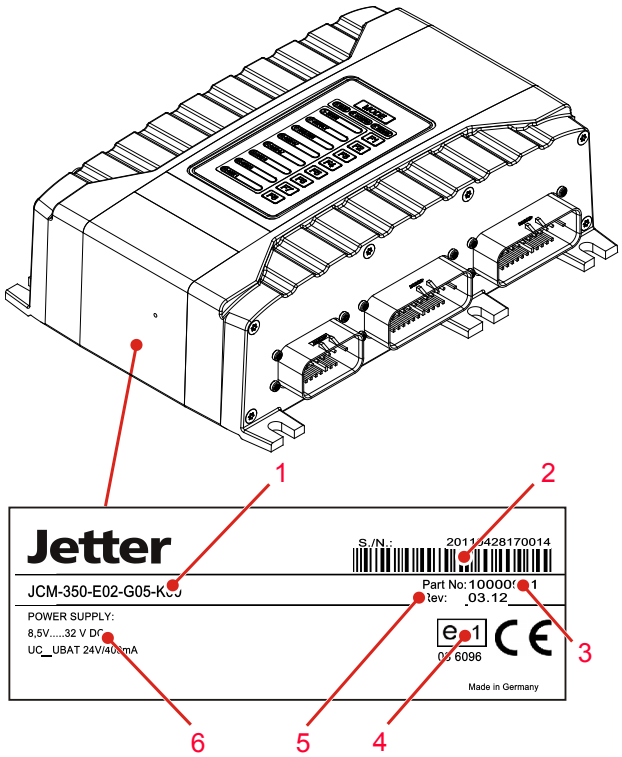
Nameplate

Nameplate

The nameplate of a JCM-350-E01/E02 contains the following information:



Number	Description
1	Controller model and module type
2	Serial number
3	Item number
4	Certification mark (e1) with registration number for automotive applications
5	Hardware revision
6	Power supply - Technical specifications

3.2 Identification via CANopen® Bus

Introduction

The JCM-350-E01/E02 features an electronic data sheet (EDS). Numerous production-relevant data are permanently stored in the EDS. EDS data can be retrieved via CANopen® bus.

The following EDS are available:

- EDS of the controller JCM-350
- EDS of I/O modules

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EDS registers of a controller

Introduction

EDS registers let you read the entries in the Electronic Data Sheet (EDS) of the controller.

Register numbers

The basic register number is dependent on the controller. The register number is calculated by adding the number of the module register (MR) and the basic register number.

Controller	Basic register number	Register numbers
JCM-350	100000	100500 ... 100999

EDS Registers of a Controller

The following table lists the EDS registers of a controller, as well as their connection to the entries in the EDS file "/System/eds.ini". As there is only one register set, select the required module via module registers 500 and 501. The contents of the selected EDS are then displayed in the following registers.

Registers	Section in eds.ini	Name in eds.ini	Description
MR 500	-	-	Functional group: 0 Controller
MR 501	-	-	Module number (if MR 500 > 0)
MR 600	IDENTIFICATION	Revision	Version of this section
MR 601		Code	Module code
MR 602 to MR 612		Name	Module name or controller name
MR 613		PcbRev	Hardware revision
MR 614		PcbOpt	Hardware revision
MR 700	PRODUCTION	Revision	Version of this section
MR 701 to MR 707		SerNum	Serial number
MR 708		Day	Production date: Day
MR 709		Month	Production date: Month
MR 710		Year	Production date: Year
MR 711		TestNum	Internal usage
MR 712		TestRev	Internal usage
MR 800	FEATURES	Revision	Version of this section
MR 801		MAC Addr	MAC address (manufacturer section)
MR 802		MAC Addr	MAC address (device section)
MR 803		Serial interface	Serial interface is available
MR 804		Switch S11	Internal usage
MR 805		STX	Runtime environment for application program

Registers	Section in eds.ini	Name in eds.ini	Description
MR 806		NVRegs	Number of remanent registers

Retrieving EDS data from the I/O module

Introduction

EDS registers on the I/O module let you read the entries in the Electronic Data Sheet (EDS). Numerous production-relevant data are permanently stored in the EDS.

Registers - Overview

EDS data can be read out of the following registers:

Registers	Description
R 600y99080	Selecting a module
R 600y99081	Selecting EDS page 0 or 1

The EDS register "Selecting a module" has been implemented for compatibility reasons. For the JCM-350-E01/E02 this register is completely irrelevant.

You can have displayed only one EDS page at a time. The registers of EDS page 0 and EDS page 1 are overlaid registers. If you simultaneously open both EDS pages in the JetSym setup window, the inactive EDS page does not display relevant data.

Contents of EDS page 0

To be able to read out EDS page 0, special register 600y99081 must contain value 0. EDS page 0 contains the following production-related data:

Registers	Type	Description
R 600y99082	int	Revision of EDS page 0
R 600y99083	int	Module code
R 600y99084	string	Module name
R 600y99095	int	Hardware revision
R 600y99096	int	Hardware revision
R 600y99097	int	Minimum OS version required to match the given hardware

Contents of EDS page 1

To be able to read out EDS page 1, special register 600y99081 must contain value 1. EDS page 1 contains the following production-related data:

Registers	Type	Description
R 600y99082	int	Revision of EDS page 1
R 600y99083	string	Serial number
R 600y99090	int	Production date: Day
R 600y99091	int	Production date: Month
R 600y99092	int	Production date: Year
R 600y99093	int	Assembly test number
R 600y99094	int	Assembly test revision

Retrieving EDS information

To retrieve EDS information, proceed as follows:

Step	Action	
1	Select the EDS page to be retrieved:	
	If ...	**... then ...**
	... you wish to read EDS page 0,	... enter 0 into register R 600y99081.
	... you wish to read EDS page 1,	... enter 1 into register R 600y99081.
2	Retrieve the information from the selected EDS page via registern R 600y99082 ... R 600y99094.	

Example: Retrieving EDS data

Task

EDS data of I/O modules on the JCM-350-E01/E02 are to be displayed in the JetSym setup window.

Solution

Declare the EDS registers as variables in a JetSym application program. The variables are then entered into the setup window.

R 600y99081 lets you toggle between EDS pages.

Prerequisites

JetSym is installed on a PC and the JCM-350-E01/E02 is connected to this PC via CANopen® adaptor.

Software versions

This sample program has been tested with the following software versions:

- JetSym version 5.1.0
- Controller JCM-350, OS version 1.12.0.06

For other sample programs, refer to JetSym online help.

JetSym STX program

```
Type
    // Defining the interface and device number
    JCM_350_E01_2_EDS:
    Struct
        // not required - but must be defined
        Module  : Int;
        // Selecting the page
        Page    : Int;
    End_Struct;

    // Defining EDS page 0
    JCM_350_E01_2_EDS_PAGE0:
    Struct
        Version         : Int;
        Code            : Int;
        ModuleName      : RegString[31];
        PCB_REV         : Int;
        PCB_Opt         : Int;
        OSVersionMin    : Int;
    End_Struct;

    // Defining EDS page 1
    JCM_350_E01_2_EDS_PAGE1:
    Struct
        Version     : Int;
        Sernum      : RegString[19];
        TS_Day      : Int;
        TS_Month    : Int;
        TS_Year     : Int;
        TestNum     : Int;
        TestRev     : Int;
```

```
    End_Struct;
End_Type;

Var
    EDS  : JCM_350_E01_2_EDS       At %VL 600199080;
    Page : Int                     At %VL 600199081;
    EDS0 : JCM_350_E01_2_EDS_PAGE0 At %VL 600199082;
    EDS1 : JCM_350_E01_2_EDS_PAGE1 At %VL 600199082;
End_Var;
```

EDS and software version of the module

Communication

Communication with the JCM-350-E01/E02 takes place via CAN bus. The communication protocol complies with the CANopen® standard. CANopen® is an open standard for networking and communication in the automobile sector.

CiA e.V. (CAN in Automation) is continuously developing the CANopen® protocol. The CANopen® protocol uses the physical layer and CAN High Speed to ISO 11898.

Electronic Data Sheet (EDS)

The Electronic Data Sheet (EDS) provides information clearly identifying the module. Data contained in the EDS are production-specific and are relevant for support purposes. The object "Electronic Data Sheet" (0x4555) lets you retrieve EDS information.

Software version of the I/O module

Use the object "Detailed Software Version" (0x4559) to read out the version of the software running in the I/O module. This read-only object returns the same software version as object 0x100A, but in a 32-bit unsigned integer format which is compatible with the standard IP-type version numbers used at Jetter AG.

Example:

The 32-bit word 0x01070001 translates to a software version of 1.07.00.01.

Useful documents

The CANopen® specifications can be obtained from the **CiA e.V. http://www.can-cia.org** homepage. The key specification documents are:

- CiA DS 301 - This document is also known as the communication profile and describes the fundamental services and protocols used under CANopen®.
- CiA DS 302 - Framework for programmable devices (CANopen® Manager, SDO Manager)
- CiA DR 303 - Information on cables and connectors
- CiA DS 4xx - These documents describe the behavior of a number of device classes in, what are known as, device profiles.

3.3 Version Registers

Introduction

The operating system of the JCM-350-E01/E02 provides several registers which let you read out the version numbers of the OS and its components. If you wish to contact the hotline of Jetter AG in case of a problem, please have this information ready.

Contents

Topic	Page
Hardware revision numbers	37
Version numbers of software running in the device	39

Hardware revision numbers

Introduction

The controller JCM-350-E01/E02 features special registers which let you identify the hardware.

Registers - Overview

The following registers let you read out the version/revision numbers of the module:

Registers	Description
R 100992	Item number
R 100993	Hardware revision of the device as a whole
R 108021	Hardware revision
R 200170	Controller type (device type)

Item number

Register R 100992 lets you read out the item number.

R 100992	Description
e. g. 10000815	Controller equipped with one I/O module

Register properties	
Type of access	Read access

Hardware revision

Register R 100993 lets you read out the hardware revision number.

Register properties	
Type of access	Read access, in IP address format

If ...	... then ...
... the value in register R 100993 < 3.11.00,	... the device is equipped with control panel model 1.
... the value in register R 100993 >= 3.11.00,	... the device is equipped with control panel model 2.

Revision numbers in the application program

To display a version/revision number in the application program use identifier *IP#*.

```
Task Check_Version autorun
    // Checking the version
    When
        JXM_Modul.Version = IP#1.01.0.39
    Continue;
    // ...
End_Task;
```

Related topics

- **Order reference/options** (see page 22)
- **Version numbers of software running in the device** (see page 39)

Version numbers of software running in the device

Introduction

The controller JCM-350-E01/E02 features software with unique version numbers which can be read out via registers.

Revision/version number format

Revision/version numbers of the JCM-350-E01/E02 are four-figure values.

1	.	2	.	3	.	4

Element	Description
1	Major or main version number
2	Minor or secondary version number
3	Branch or intermediate version number
4	Build version number

Released version

A released version can be recognized by both Branch and Build having got value zero.

OS version number of the controller

The controller's EDS lets you read out its OS version number.

If a CANopen® connection with the controller exists, JetSym displays the OS version number in its title bar.

Register overview - I/O modules

The following registers let you read out the version/revision numbers of the I/O modules:

Registers	Description
R 600y98300	Operating system version
R 600y98302	FPGA revision
R 600y98304	Bootloader version

Meaning of "y"

The parameter "y" stands for the number of I/O modules.

Thus, y = 1 stands for one I/O module, and y = 2 for two I/O modules.

Operating system version

The following registers let you retrieve the OS version numbers of the devices:

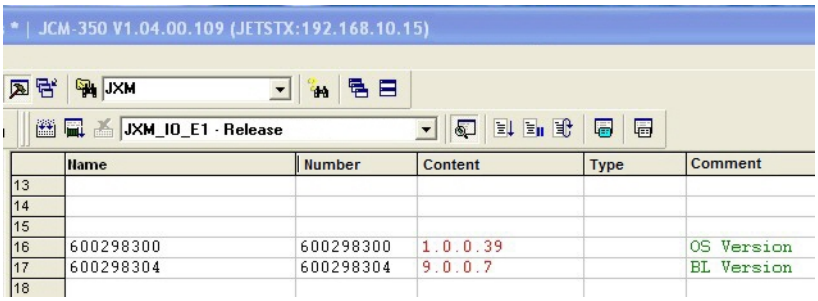
Registers	Description
R 600198300	OS version for ■ JCM-350-E01-G05-K00, I/O module 1 ■ JCM-350-E01-G12-K00, I/O module 1
R 600298300	OS version for ■ JCM-350-E02-G05-K00, I/O module 2 ■ JCM-350-E02-G12-K00, I/O module 2

Note

Models having the string "E02" in their designation hold two EDS. Dedicated registers let you retrieve EDS information. For more information refer to **EDS registers** (see page 31).

Version numbers in JetSym setup

To have the version number displayed in the setup window of JetSym, select the format "IP address".



Software versions

This sample program has been tested with the following software versions:

- JetSym version 5.1.0
- Controller JCM-350, OS version 1.12.0.06

For other sample programs, refer to JetSym online help.

Revision numbers in the application program

To display a version/revision number in the application program use identifier *IP#*.

```
Task Check_Version autorun
    // Checking the version
    When
        JXM_Modul.Version = IP#1.01.0.39
    Continue;
    // ...
End_Task;
```

Related topics

- **Hardware revision numbers** (see page 37)
- **EDS registers** (see page 31)

4 Mounting and installation

Purpose of this chapter

This chapter is for supporting you in mounting and installing the JCM-350-E01/E02 in the vehicle and covers the following topics:

- Planning the wiring layout
- Connecting the power supply
- Connecting sensors and actuators
- Selecting the proper location of installation and installation hardware

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4.1 Installing the controller JCM-350-E01/E02

Introduction

This chapter describes how to install the controller JCM-350-E01/E02.

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Installation

Introduction

This chapter describes how to install the JCM-350-E01/E02. Take into account that the models **G05** and **G12** have different installation dimensions.

Selecting a place for installation

Select a suitable place for the device to be mounted.

A place is suitable if it fulfills the following requirements:

- The installation surface must be made from one of the following materials:
  - Aluminum plate
  - Galvanized steel plate
  - Lacquered steel plate
- The installation surface must be level.
- The installation location must allow air to circulate.
- The installation location must be accessible for servicing.
- The installation location must be of sufficient size.

Mounting orientation

This device can be installed in vertical or horizontal orientation.

Avoiding unsuitable installation locations

Do not install the device in inappropriate locations.

The following locations are not appropriate for installing the JCM-350-E01/E02:

Unsuitable installation location	Reason
Unventilated installation location	The device could overheat as heat builds up.
Installation location close to heat-sensitive materials	The materials could become warped or misshapen as a result of heat produced by the device.
Installation surfaces are uneven	The installation surface could become misshapen when fitting the device. Installation is unstable and precarious.

Selecting installation hardware

Installation hardware is not included in the scope of delivery.

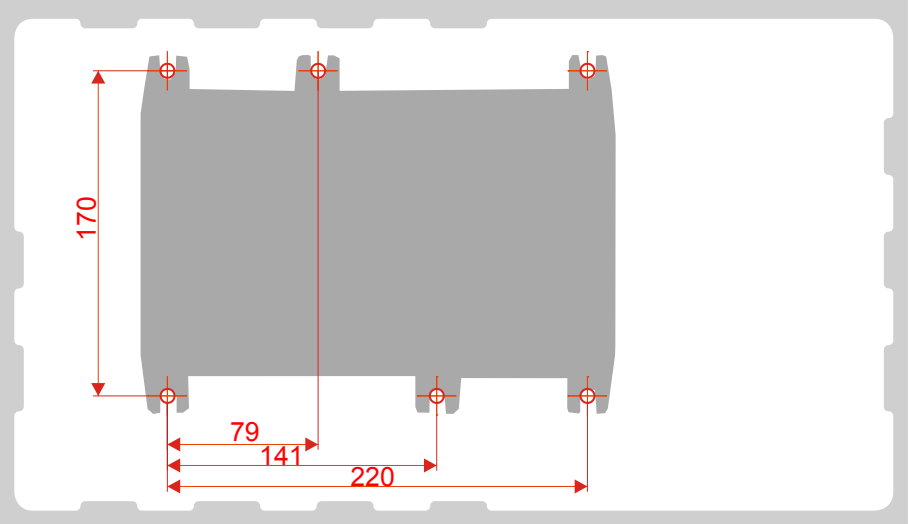
For installation use the following hardware:

Element	Description
Screws/bolts	Size: M 5 x 15 or M 6 x 15 Zinc coated Strenght class: 8.8
Washers	Size: Ø ≤ 11 Zinc coated
Screw nuts (only in the case of drilled holes without thread)	Size: M 5 or M 6 Zinc coated Strenght class: 8.8

Preparing for installation

The mounting holes on models G05 and G12 are the same.

Mark off the positions of the mounting holes. Center-punch the 6 holes.



If ...	... then ...
... the thickness of the mounting surface is ³ 6 mm (steel) or ³ 8 mm (aluminum),	... drill tapped holes: ■ Pre-drill Ø 4.2 mm. ■ Tap a thread M 5.
... the thickness of the mounting surface is < 6 mm (steel) or < 8 mm (aluminum),	... drill simple holes: ■ Drill the holes Ø 6 mm. ■ Deburr the holes.

Ensuring heat dissipation

Direct contact between housing and mounting surface improves heat dissipation.

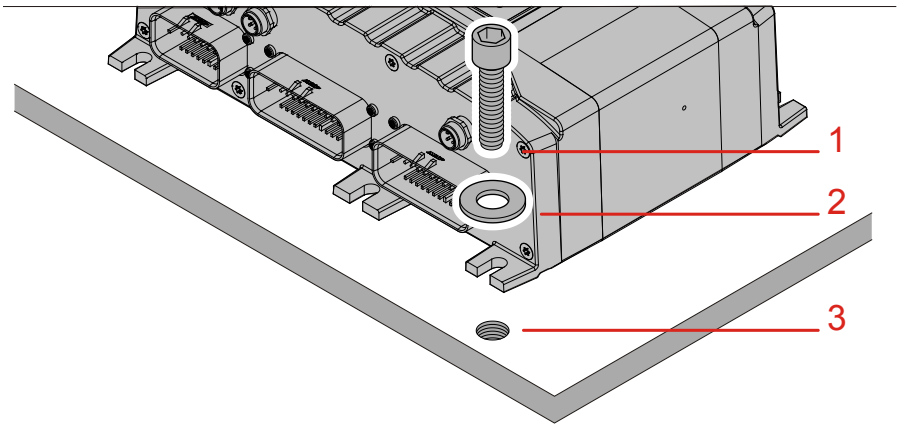
Please note:

- Install the device directly on the mounting surface.
- Do not use insulating material.
- Do not use spacers.

Fastening the device to the mounting surface (with tapped holes)

To fasten the device to a mounting surface with tapped holes, proceed as follows:

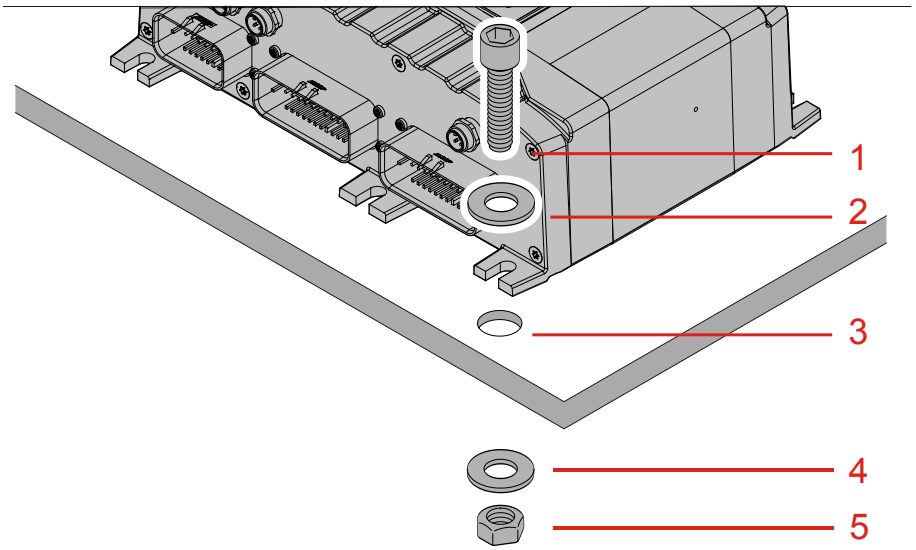
Step	Action
1	Screw down the device using 4 screws. (Screws: 4 x M5, not included in the scope of delivery)
2	Connect the cables leading to the connectors on the device.



Number	Description
1	Screw
2	Washer
3	Tapped hole

Fastening the device to the mounting surface (with drilled holes)

Screw down the device as shown in the illustration:



Number	Description
1	Screw
2	Washer
3	Through hole
4	Washer
5	Screw nut

Related topics

- **Physical dimensions** (see page 23)

4.2 Wiring

Purpose of this chapter

This chapter describes how to wire the JCM-350-E01/E02 and covers the following topics:

- Wiring principle
- Example of wiring
- Power supply
- Pin assignment
- Technical specifications

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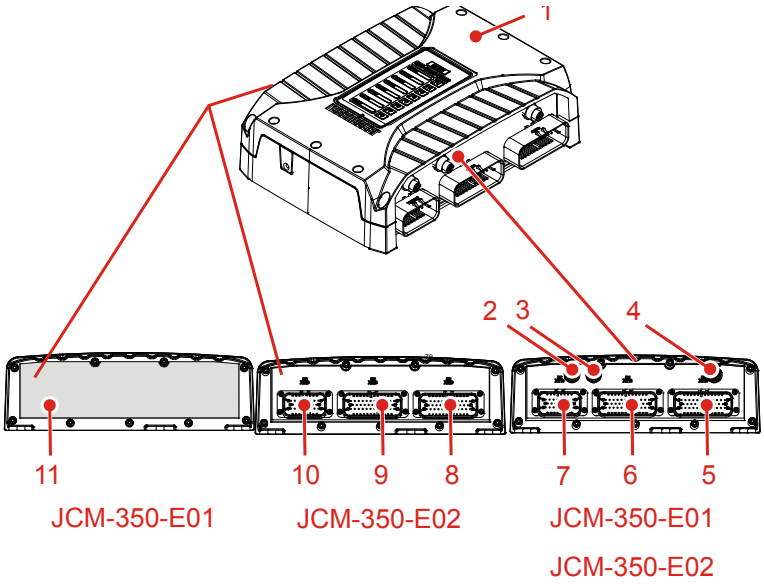
Connecting peripheral devices to the JCM-350-E01/E02	58
JCM-350-E01/E02 - I²t monitoring	81

Wiring principle

Overview - Interfaces

The device JCM-350-E01/E02 is equipped with the following interfaces:



No.	Description
1	General view with control panel
2	CAN3, circular connector M12 (interface to the next bus node)
3	CAN1, circular connector M12 (interface to the next bus node)
4	CAN2, circular connector M12 (interface to the next bus node)
5	X119, 35-pin AMPSEAL connector to interface with peripheral devices (black)
6	X118, 35-pin AMPSEAL connector to interface with peripheral devices (orange)
7	X110, 23-pin AMPSEAL connector to interface with peripheral devices (black)
8	Only with JCM-350-E02: X219, 35-pin AMPSEAL connector to interface with peripheral devices (black)
9	Only with JCM-350-E02: X218, 35-pin AMPSEAL connector to interface with peripheral devices (orange)
10	Only with JCM-350-E02: X210, 23-pin AMPSEAL connector to interface with peripheral devices (black)
11	Only with JCM-350-E02: Closed side panel

Power supply

The AMPSEAL connectors are used to supply the JCM-350-E01/E02 with power.

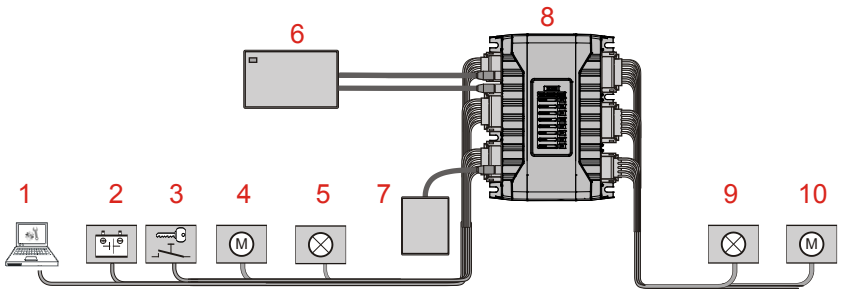
Wiring principle

The different connectors let you connect the JCM-350-E01/E02 with external components.

Example:

- Power supply
- Human-machine interfaces
- Actuators
- Sensors
- Indicator lights
- etc.

The mating connectors are not included in the scope of delivery of the JCM-350-E01/E02.



Number	Description
1	PC or notebook with CAN interface (for service purposes only)
2	Power supply (battery)
3	Ignition lock (to be connected with ignition)
4	Electric motor
5	Bulb (e. g. low beam)
6	Device 1 with two CAN interfaces
7	Device 2 with one CAN interface
8	JCM-350-E01/E02
9	Bulb (e. g. turn signal)
10	Actuator (e. g. electric motor)

4.2.1 JCM-350-E01/E02 - Power supply

Introduction

This chapter describes how to supply the JCM-350-E01/E02 with power.

Power supply of electronic system

The electronic system of the JCM-350-E01/E02 can be supplied with voltage (UC_UBAT) in different ways. When you engineer the voltage supply, take the following aspects into account:

- Power supply directly from the battery (terminal 30)
- Power supply via ignition lock (terminal 15)
- Maximum current per supply line

Connecting the power supply to a JCM-350-E01/E02:

- Connect the power supply of a JCM-350-E01 to connectors X118 and X119.
- Connect the power supply of a JCM-350-E02 to connectors X118, X119, X218 and X219.

Differences in ground reference:

- The ground reference of G05 models is connected with the enclosure.
- The ground reference of G12 models is isolated from the enclosure.

Properties of JCM-350-E01/E02

- When you power up the JCM-350-E01/E02, the inrush current may several times exceed the normal operating current. Take this fact into account when defining the fuse rating.
- If the power supply of the controller JCM-350 via X119.12 or X219.12 (only on JCM-350-E02) is interrupted, for example due to a broken wire, the controller is supplied through the following external power supplies:
  - Power supply of H-bridges
  - Power supply of digital ouputs
  - Power supply of PWM outputs
- You are free to choose to supply the controller via ignition (terminal 15) or directly from the battery (terminal 30).

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Connecting the supply voltage to X118/X218

Introduction

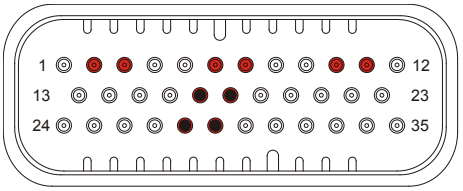
This chapter describes the pin assignment of AMPSEAL connector X118/X218 for supplying the JCM-350-E01/E02 with power.

The mating connector is a 35-pin AMPSEAL jack.

Power supply via X118/X218

The illustration below shows the pin assignment of the connector X118/X218 with power supply and reference potentials:

Connect the power supply from the battery as shown below:



Pin	Description
2	Power supply of digital outputs 5 ... 8
3	Power supply of digital outputs 5 ... 8
6	Power supply of H-bridge 1
7	Power supply of H-bridge 1
10	Power supply of H-bridge 2
11	Power supply of H-bridge 2
17	Reference potential
18	Reference potential
28	Reference potential
29	Reference potential

Note on cables

The connecting cable must meet the following requirements:

Parameter	Description
Core cross-section	From 0.75 mm^2 to 1.5 mm^2 (AWG 20 ... 16)
Minimum insulation diameter	1.7 mm
Maximum insulation diameter	2.7 mm

Power supply of digital outputs 5 ... 8 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Current consumption	Sum of output currents of digital outputs 5 ... 8
Connecting pins	X118.2, X118.3/ X218.2, X218.3

Power supply of H-bridge 1 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Total output current - H-bridge 1
Maximum output current	16 A
Connecting pins	X118.6, X118.7/ X218.6, X218.7

Power supply of H-bridge 2 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Total output current - H-bridge 2
Maximum output current	16 A
Connecting pins	X118.10, X118.11/ X218.10, X218.11

Related topics

- **Pin assignment X118** (see page 248)
- **Pin assignment X218** (see page 255)

Connecting the supply voltage to X119/X219

Introduction

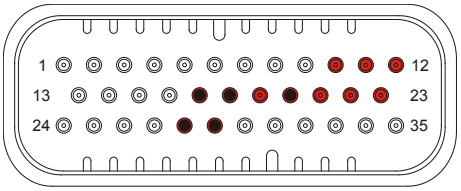
This chapter describes the pin assignment of AMPSEAL connector X119/X219 for supplying the JCM-350-E01/E02 with power.

The mating connector is a 35-pin AMPSEAL jack.

Power supply via X119/X219

The illustration below shows the pin assignment of the connector X119/X219 with power supply and reference potentials:

Connect the power supply from the battery as shown below:



Pin	Description
10	Power supply of digital outputs 1 ... 4
11	Power supply of digital outputs 1 ... 4
12	Power supply of electronic system and pins X119.31, X219.31, X110.18 and X210.18.
17	Reference potential
18	Reference potential
19	Power supply of analog outputs
20	Reference potential
21	Power supply of PWM outputs
22	Output: Power supply of external analog peripheral devices
23	Power supply of digital inputs
28	Reference potential
29	Reference potential

Note on power supply

The size of the power supply unit line must be rated at a minimum current of 2.2 A.

Pins X119.12 and X219.12 supply the following components:

- Electronic system of JCM-350-E01/E02
- Pins X119.31, X219.31 supply the sensors of external analog peripherals with power, maximum current 1 A
- Pins X110.18, X210.18 supply the sensors of external digital peripherals with power, maximum current 1 A

Note on cables

The connecting cable must meet the following requirements:

Parameter	Description
Core cross-section	From 0.75 mm^2 to 1.5 mm^2 (AWG 20 ... 16)
Minimum insulation diameter	1.7 mm
Maximum insulation diameter	2.7 mm

Power supply of digital outputs 1 ... 4 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Current consumption	Sum of output currents of digital outputs 1 ... 4
Connecting pins	X119.10, X119.11/ X219.10, X219.11

Power supply UC_UBAT - Technical specifications

Parameter	Description
Operating voltage - device	DC 7 V ... 32 V
Operating voltage - controller	≥ DC 5.5 V
Typical input current (at 24 V power supply)	200 mA + encoder supply (only for **G12** models)
Connecting pins	X119.12/X219.12

Power supply of analog output - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Corresponds to the total output power of all analog outputs
Maximum input current	400 mA
Connecting pins	X119.19/X219.19

Power supply of PWM outputs - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current (at PWM power supply = 24 V)	Corresponds to the total output power of all PWM outputs
Maximum total output current of all PWM outputs	8 A
Connecting pins	X119.21/X219.21

Power supply of digital inputs - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current (at 24 V power supply)	150 mA
Connecting pins	X119.23/X219.23

Power supply of analog inputs - Technical data

The following information applies only to JCM-350-**G05**:

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Peak current	1 A
Connecting pins	X119.22/X219.22

Related topics

- **Pin assignment X119** (see page 258)
- **Pin assignment X219** (see page 258)

Sensor supply voltage

Introduction

There are two sensor supply systems for supplying external analog and digital electronic circuits. Both sensor supply systems can be activated from the JCM-350-E01/E02.

Sensor supply properties

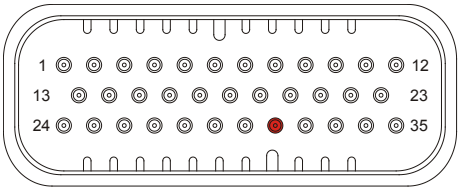
Parameter	Description
Protection	Electronic activation (only on **G12** models)
Maximum current for digital electronics	■ 1 A continuous current ■ 2.5 A maximum current
Maximum current for analog electronics	■ 1 A continuous current ■ 2.5 A maximum current
Overload behavior	If the maximum current per output is exceeded, the sensor supplies start to pulsate (only on **G12** models)

Ensure that on a **G05** model the maximum current does not exceed the following limits:

- 1 A for digital peripherals
- 1 A for analog peripherals

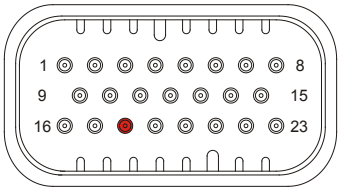
Sensor supply - Pins

The illustration below shows the pins used for sensor supply:



X119

X219



X110

X210

Pin	Socket	Description
31	X119	Sensor supply for analog peripherals
31	X219	Sensor supply for analog peripherals
18	X110	Sensor supply for digital peripherals
18	X210	Sensor supply for digital peripherals

Related topics

- **Pin assignment X110** (see page 253)
- **Pin assignment X210** (see page 253)
- **Pin assignment X119** (see page 258)
- **Pin assignment X219** (see page 258)

4.2.2 Connecting peripheral devices to the JCM-350-E01/E02

Introduction

This chapter describes how to use the inputs/outputs of the JCM-350-E01/E02.

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Connecting analog inputs

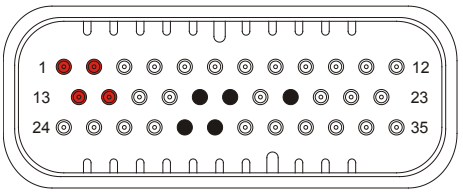
Introduction

Connect analog inputs to connector X119/X219. Each of the four analog inputs can be configured for one of the following measuring ranges:

- Voltage: 0 ... +10 V
- Voltage: 0 ... +32 V
- Current: 0 ... 20 mA
- Current: 4 ... 20 mA
- Ratiometric voltage measurement

Analog inputs - Pin assignment

The illustration below shows the pin assignment for analog inputs and their ground references.



X 119

X 219

Pin	Connector	Description
1	X119	Analog input 104
1	X219	Analog input 204
2	X119	Analog input 103
2	X219	Analog input 203
13	X119	Analog input 102
13	X219	Analog input 202
14	X119	Analog input 101
14	X219	Analog input 201
17	X119 / X219	Ground reference
18	X119 / X219	Ground reference
20	X119 / X219	Ground reference
28	X119 / X219	Ground reference
29	X119 / X219	Ground reference

Analog inputs - Technical specifications

Parameter	Description
Maximum input voltage for voltage measurements	+32 V
Maximum input current for current measurements	22.5 mA (+9 V)
Resolution	12 bits
Accuracy	99.5 %
Input frequency	50 Hz
Limit frequency of 10 V range	250 Hz, 3 dB attenuation of input signal, Input impedance: 43 kΩ
Limit frequency of 32 V range	660 Hz, 3 dB attenuation of input signal, Input impedance: 35 kΩ
Input impedance (voltage)	35 kΩ / 43 kΩ
Input impedance (current)	400 Ω

Power supply of analog inputs - Technical data

The following information applies only to JCM-350-**G05**:

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Peak current	1 A
Connecting pins	X119.22/X219.22

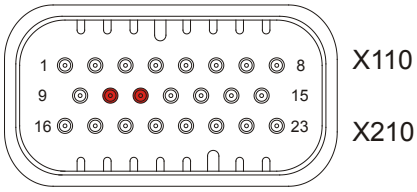
Related topics

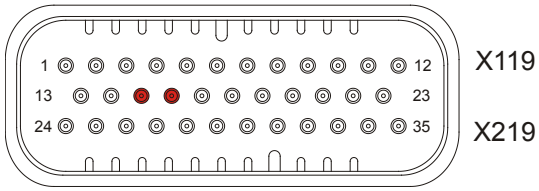
- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: Retrieving analog values** (see page 226)

Connecting analog outputs

Analog outputs - Pin assignment

The JCM-350-E01/E02 features power supply monitoring for analog outputs. The illustrations below show the pin assignment for analog outputs and their ground references.





Connector X110/X210:

Pin	Connector	Description
10	X110	Analog output 101
10	X210	Analog output 201
11	X110	Analog output 101
11	X210	Analog output 201
17	X110 / X210	Ground reference

Connector X119/X219:

Pin	Connector	Description
15	X119	Analog output 101
15	X219	Analog output 201
16	X119	Analog output 101
16	X219	Analog output 201
17	X119 / X219	Ground reference
18	X119 / X219	Ground reference
20	X119 / X219	Ground reference
28	X119 / X219	Ground reference
29	X119 / X219	Ground reference

Analog inputs - Technical specifications

Parameter	Description
Configurable output voltage range	DC 0 V ... DC 10 V, maximum supply voltage for analog outputs DC 0 V ... DC 32 V, maximum supply voltage for analog outputs
Maximum output current	100 mA
Accuracy related to ultimate voltage value	99 %

Power supply of analog output - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Corresponds to the total output power of all analog outputs
Maximum input current	400 mA
Connecting pins	X119.19/X219.19

Related topics

- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: Outputting analog values** (see page 231)

CAN interfaces - Connection

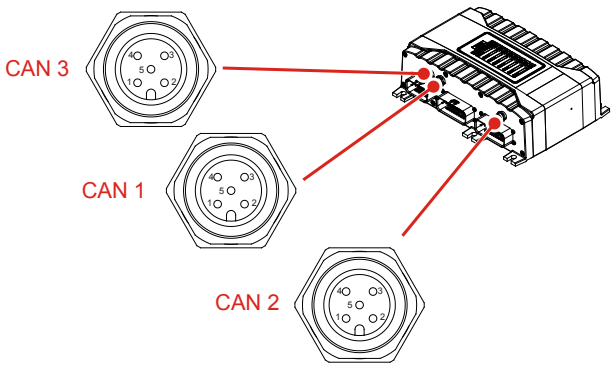
Introduction

This chapter describes the pin assignment of the different CAN ports (interfaces).

The JCM-350-E01/E02 has five separate CAN interfaces.

Overview - CAN Interfaces

The illustration below shows the CAN connectors of the JCM-350-E01/E02:

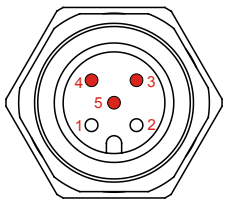


These connectors are 5-pin male connectors (thread M12) by Binder.

M12 CAN interface

The illustration below shows the pin assignment of the CAN interface. The pin assignment is identical for connectors 1 ... 3.

Letter x is used in the table as placeholder for the corresponding CAN interface: **x = 1 ... 3**.



Pin	Description
1	-
2	-
3	■ On **G05** models: Ground reference and enclosure ■ On **G12** models: Not used
4	CAN-High of interface x
5	CAN-Low of interface x

Note on cables

The cable of the mating connector must meet the following requirements:

Parameter	Description
Cable type	CAN 5-pin (CAN-H and CAN-L twisted, shielded)
Minimum core cross-section	0.34 mm²
Maximum cable length at 250 kbits/s	< 50 m

Mating parts

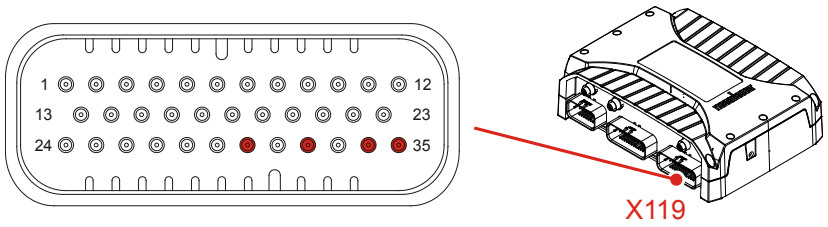
The following mating connectors are compatible with the 5-pin connector M12:

- 5-pin connector (female) M12 by Binder
- 5-pin connector (female) M12 by Escha

These mating connectors are not included in the scope of delivery.

CAN interfaces 4 and 5

CAN interfaces 4 and 5 are implemented in connector X119.



Pin	Signal	Description
34	CAN-H	CAN High, interface 4
32	CAN-L	CAN Low, interface 4
35	CAN-H	CAN High, interface 5
30	CAN-L	CAN Low, interface 5

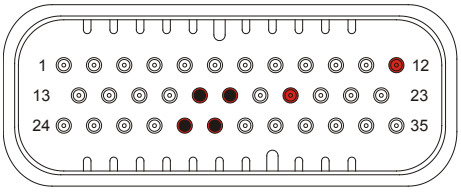
CAN interface - Technical specifications

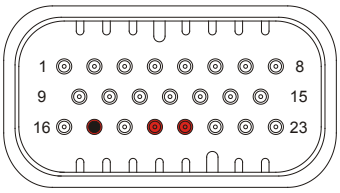
Parameter	Description
Baud rates	250 kBaud
Bus termination	None
External termination recommended	120 Ω

Connecting digital frequency/pulse inputs

Connecting digital frequency/pulse inputs

Frequency/pulse inputs let you capture the frequency of digital signals. The illustrations below show the pin assignment for frequency/pulse inputs and their ground references.





Connector X118/X218:

Pin	Connector	Description
12	X118	Frequency input 101
12	X218	Frequency input 201
17	X118 / X218	Ground reference
18	X118 / X218	Ground reference
20	X118	Frequency input 102
20	X218	Frequency input 202
28	X118 / X218	Ground reference
29	X118 / X218	Ground reference

Connector X110/X210:

Pin	Connector	Description
17	X110 / X210	Ground reference
19	X110	Frequency input 103
19	X210	Frequency input 203
20	X110	Frequency input 104
20	X210	Frequency input 204

Frequency/pulse inputs - Technical specifications

Parameter	Description
Type of inputs	Active-low inputs with pull-down resistor
Permissible voltage range	DC 0 V ... DC 32 V
Threshold level OFF	■ < 0.3 x supply voltage of digital inputs for JCM-350-Exx-G05 ■ < 0.2 x supply voltage of digital inputs for JCM-350-Exx-G12
Threshold level ON	■ > 0.7 x supply voltage of digital inputs for JCM-350-Exx-G05 ■ > 0.3 x supply voltage of digital inputs for JCM-350-Exx-G12
Typical input resistance	3.2 kΩ
Typical input current	7.5 mA
Maximum input frequency	50 kHz

Related topics

- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: Retrieving frequency inputs** (see page 202)

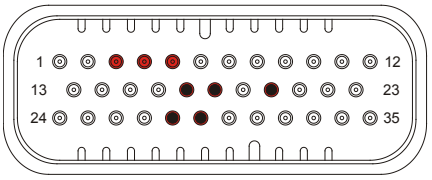
Connecting digital inputs

Introduction

Up to 11 digital inputs can be connected to connectors X118/X218. Software lets you configure each digital input as Active-High input or as Active-Low input. Each input can be configured individually irrespective of the configuration of the other inputs.

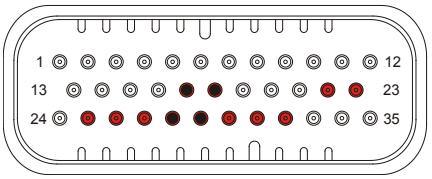
Connecting digital inputs

The illustrations below show the pin assignment for digital inputs and their ground references.



X119

X219



X118

X218

Connector X119/X219:

Pin	Connector	Description
3	X119	Digital input 103
3	X219	Digital input 203
4	X119	Digital input 102
4	X219	Digital input 202
5	X119	Digital input 101
5	X219	Digital input 201
17	X119 / X219	Ground reference
18	X119 / X219	Ground reference
20	X119 / X219	Ground reference
28	X119 / X219	Ground reference
29	X119 / X219	Ground reference

Connector X118/X218:

Pin	Connector	Description
17	X118 / X218	Ground reference
18	X118 / X218	Ground reference
25	X118	Digital input 104
25	X218	Digital input 204

Pin	Connector	Description
26	X118	Digital input 105
26	X218	Digital input 205
27	X118	Digital input 106
27	X218	Digital input 206
28	X118 / X218	Ground reference
29	X118 / X218	Ground reference
30	X118	Digital input 107
30	X218	Digital input 207
31	X118	Digital input 108
31	X218	Digital input 208
32	X118	Digital input 109
32	X218	Digital input 209
23	X118	Digital input 110
23	X218	Digital input 210
22	X118	Digital input 111
22	X218	Digital input 211

Note on power supply

Active-high and active-low inputs are evaluated in different ways:

- Active-high inputs are measured against reference ground.
- Active-low inputs are measured against the digital supply voltage.

Switching status

Depending on the configuration (active-high or active-low) the following switching statuses are possible:

Configuration	State	Result in register R 600y001xx
0 = Active-low input	n.c.	0
	24 V	0
	0 V	1
1 = Active-high input	n.c.	0
	24 V	1
	0 V	0

Note:

The abbreviation "n.c." stands for "not connected". The placeholder "xx" stands for digital input 01 ... 11.

Digital Inputs - Technical Data

Parameter	Description
Type of inputs	Active-high or active-low input (programmable)
Permissible voltage range	DC 7.5 V ... DC 32 V
Typical threshold level OFF	Active-high: < 0.3 x supply voltage of digital inputs Active-low: > 0.7 x supply voltage of digital inputs
Typical threshold level ON	Active-high: > 0.7 x supply voltage of digital inputs Active-low: < 0.3 x supply voltage of digital inputs
Typical input resistance	3.2 kΩ
Typical input current (U = 24 V)	7.5 mA
Maximum input frequency	50 Hz

Power supply of digital inputs - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current (at 24 V power supply)	150 mA
Connecting pins	X119.23/X219.23

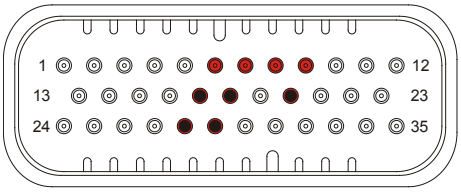
Related topics

- **Pin assignment X119** (see page 250)
- **Pin assignment X219** (see page 258)
- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: Retrieving digital values** (see page 197)

Connecting digital outputs

Pin assignment of connectors X119/X219

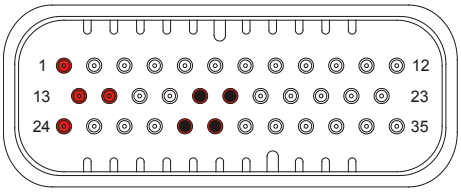
The illustration below shows the pin assignment for digital outputs and their ground references.



Pin	Connector	Description
6	X119	Digital output 102
6	X219	Digital output 202
7	X119	Digital output 104
7	X219	Digital output 204
8	X119	Digital output 101
8	X219	Digital output 201
9	X119	Digital output 103
9	X219	Digital output 203
17	X119 / X219	Ground reference
18	X119 / X219	Ground reference
20	X119 / X219	Ground reference
28	X119 / X219	Ground reference
29	X119 / X219	Ground reference

Pin assignment of connectors X118/X218

The illustration below shows the pin assignment for digital outputs and their ground references.



Pin	Connector	Description
1	X118	Digital output 106
1	X218	Digital output 206
13	X118	Digital output 105
13	X218	Digital output 205
14	X118	Digital output 108
14	X218	Digital output 208

Pin	Connector	Description
17	X118 / X218	Ground reference
18	X118 / X218	Ground reference
24	X118	Digital output 107
24	X218	Digital output 207
28	X118 / X218	Ground reference
29	X118 / X218	Ground reference

Digital outputs - Technical specifications

Parameter	Description
Maximum rated current per output	8 A
Total current for outputs 101 ... 104	16 A
Total current for outputs 105 ... 108	16 A
Total current for outputs 201 ... 204	16 A
Total current for outputs 205 ... 208	16 A
Switching frequency	100 Hz
Allowed overload current per output during power-up	40 A for 500 ms
Allowed overload current per output during power-up	16 A for 4 s
Minimum voltage per output; dependent on the supply voltage for digital outputs	7.0 V
Maximum voltage per output; dependent on the supply voltage for digital outputs	32 V

Power supply of digital outputs 1 ... 4 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Current consumption	Sum of output currents of digital outputs 1 ... 4
Connecting pins	X119.10, X119.11/ X219.10, X219.11

Power supply of digital outputs 5 ... 8 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Current consumption	Sum of output currents of digital outputs 5 ... 8
Connecting pins	X118.2, X118.3/ X218.2, X218.3

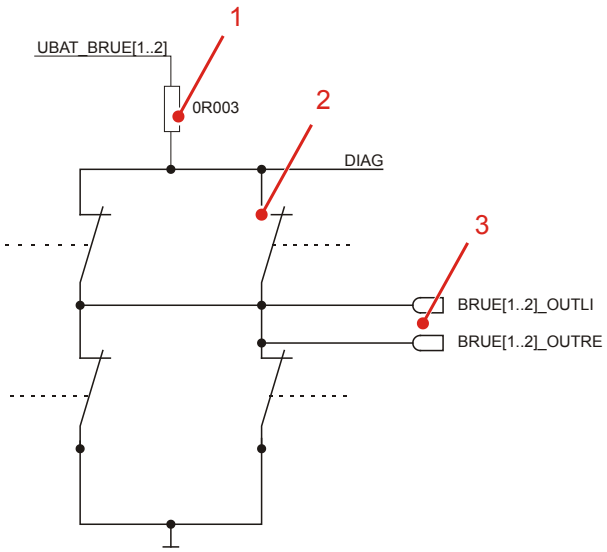
Related topics

- **Connecting the supply voltage to X118/X218** (see page 51)
- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: Outputting digital values** (see page 192)

Connecting H-bridges

Block diagram

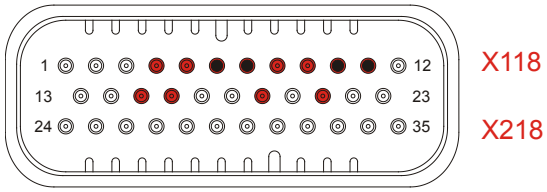
The block diagram below is a simplified illustration of the H-bridges. These H-bridges are controlled by electronic switches.



Number	Description
1	A shunt resistor in the H-bridge supply line measures the total current
2	Symbolically depicted: H-bridge switch
3	H-bridge outputs

Connecting H-bridges

The controller JCM-350-E01/E02 monitors the power supply of H-bridges. The illustration below shows the pin assignment for H-bridges and their ground references.



Pin	Connector	Description
4, 15	X118	H-bridge output 101, right
4, 15	X218	H-bridge output 201, right
5, 16	X118	H-bridge output 101, left
5, 16	X218	H-bridge output 201, left
6	X118 / X218	H-bridge ground reference
7	X118 / X218	H-bridge ground reference
8, 19	X118	H-bridge output 102, right
8, 19	X218	H-bridge output 202, right

Pin	Connector	Description
9, 21	X118	H-bridge output 102, left
9, 21	X218	H-bridge output 202, left
10	X118 / X218	H-bridge ground reference
11	X118 / X218	H-bridge ground reference

H-bridges 1/2 - Technical specifications

Parameter	Description
Voltage supply of outputs	0.3 V
Overload behavior	80 A for 500 ms 32 A for 4 s
Current measurement, resolution	12 bits
Accuracy related to twice the rated current	95 %
Switching frequency (1/period length)	100 Hz ... 4 kHz
Frequency accuracy	100 ppm
Resolution of pulse control factor	20 ns

Power supply of H-bridge 1 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Total output current - H-bridge 1
Maximum output current	16 A
Connecting pins	X118.6, X118.7/ X218.6, X218.7

Power supply of H-bridge 2 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Total output current - H-bridge 2
Maximum output current	16 A
Connecting pins	X118.10, X118.11/ X218.10, X218.11

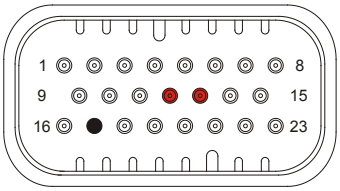
Related topics

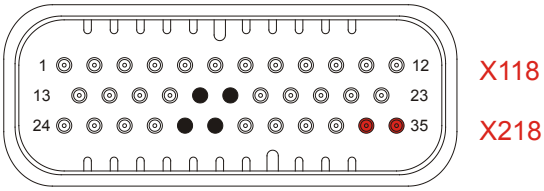
- **Connecting the supply voltage to X118/X218** (see page 51)
- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: H-bridge** (see page 217)

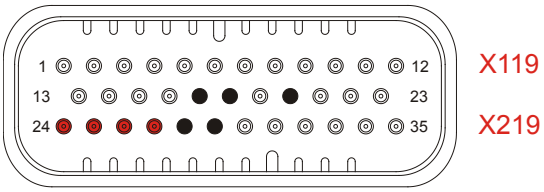
Connecting PWM outputs

Connecting PWM outputs

The controller JCM-350-E01/E02 monitors the power supply of PWM outputs. The illustrations below show the pin assignment for PWM outputs and their ground references.







Connector X110/X210:

Pin	Connector	Description
12	X110	PWM output 107
12	X210	PWM output 207
13	X110	PWM output 108
13	X210	PWM output 208
17	X110 / X210	Ground reference

Connector X118/X218:

Pin	Connector	Description
17	X118 / X218	Ground reference
18	X118 / X218	Ground reference
28	X118 / X218	Ground reference
29	X118 / X218	Ground reference
34	X118	PWM output 105
34	X218	PWM output 205
35	X118	PWM output 106
35	X218	PWM output 206

Connector X119/X219:

Pin	Connector	Description
17	X119 / X219	Ground reference
18	X119 / X219	Ground reference
20	X119 / X219	Ground reference
24	X119	PWM output 101
24	X219	PWM output 201
25	X119	PWM output 102
25	X219	PWM output 202
26	X119	PWM output 103
26	X219	PWM output 203
27	X119	PWM output 104
27	X219	PWM output 204
28	X119 / X219	Ground reference
29	X119 / X219	Ground reference

PWM outputs - Technical specifications

Parameter	Description
Type of outputs	High-side
Nominal current of individual outputs	2 A
Typical output voltage at nominal current	Power supply PWM -200
Overload protection at power-up	10 A for 500 ms 4 A for 4 s
Total current of all 8 PWM outputs	8 A
Clock frequency	25 Hz ... 1 KHz Can be configured in steps of 25 Hz
Frequency accuracy	95 %
Resolution of pulse control factor	20.083 ns
Accuracy of pulse control factor	±2 µs
Switch-on frequency under overload conditions	Depending on thermal overall condition
Switch-on frequency without overload	No restriction
Load	Resistive, inductive, lamps
Protective circuitry	Capacitive, free-wheeling diode
Diagnostic functions	Overload, short circuit

Power supply of PWM outputs - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current (at PWM power supply = 24 V)	Corresponds to the total output power of all PWM outputs
Maximum total output current of all PWM outputs	8 A
Connecting pins	X119.21/X219.21

Related topics

- **Connecting the supply voltage to X119/X219** (see page 53)
- **Programming: PWM outputs** (see page 211)

Connecting relays

Introduction

Connector X110/X210 lets you connect four relay contacts.
The JCM-350-E01/E02 is equipped with two different relay types. These two relay types are rated at different breaking currents.

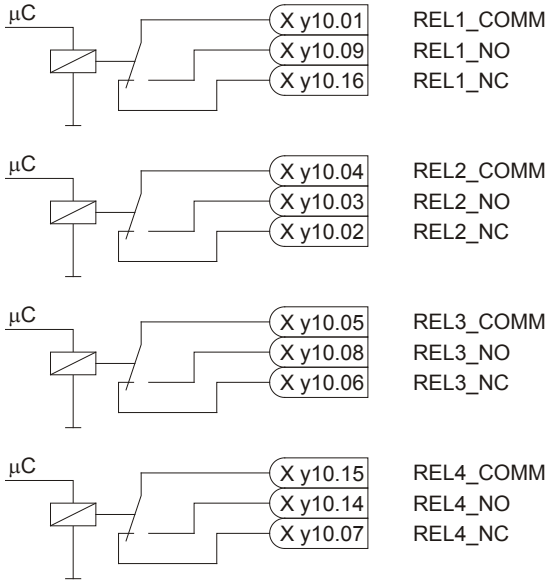
- Relay 101, 102, 201, 202 High-current relay
- Relay 103, 104, 203, 204 Standard relay

Block diagram

Abbreviations used in the block diagram:

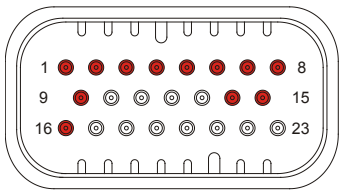
- COMM for Common
- NO for Normally Open
- NC for Normally Closed

y = 1 : JCM-350-E01-xxx
y = 2 : JCM-350-E02-xxx



Connecting relays

The illustration below shows the pin assignment of the relays.



X 110
X 210

Pin	Socket	Description
1	X110	Common - relay 101
1	X210	Common - relay 201
9	X110	NO - relay 101
9	X210	NO - relay 201
16	X110	NC - relay 102
16	X210	NC - relay 202
4	X110	Common - relay 102
4	X210	Common - relay 202
3	X110	NO - relay 102
3	X210	NO - relay 202
2	X110	NC - relay 102
2	X210	NC - relay 202
5	X110	Common - relay 103
5	X210	Common - relay 203
8	X110	NO - relay 103
8	X210	NO - relay 203
6	X110	NC - relay 103
6	X210	NC - relay 203
15	X110	Common - relay 104
15	X210	Common - relay 204
14	X110	NO - relay 104
14	X210	NO - relay 204
7	X110	NC - relay 104
7	X210	NC - relay 204

High-current relay - Technical specifications

Parameter	Description
Relay type 101, 102, 201, 202	Minirelais K (Infineon)
Contact	1 x UM
Permissible voltage range	DC 5 V ... DC 32 V
Permissible current	0.5 A ... 15 A

Standard relay - Technical specifications

Parameter	Description
Relay type 103, 104, 203, 204	Cp1 Relay (Nais)
Contact	1 x UM
Permissible voltage range	DC 5 V ... DC 32 V
Permissible current	0.5 A ... 2 A

In the case of inductive loads, install an appropriate contact protection (free-wheeling diode, spark suppressor).

Related topics

- **Programming: Relay outputs** (see page 215)
- **Pin assignment X110** (see page 246)
- **Pin assignment X210** (see page 253)

4.2.3 JCM-350-E01/E02 - I²t monitoring

Introduction

This chapter describes I^2t monitoring implemented in JCM-350-E01/E02.

This feature uses I^2t graphs for monitoring purposes. If the current per unit of time exceeds the limit, the controller issues an error message.

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Retrieving I²t monitoring data

I²t curve

The I^2t curve is a measure of load and internal heating-up of the device.
I^2t monitoring is available for the following outputs:

- H-bridges
- Digital outputs 1 ... 8
- Total current of power supply for digital outputs 1 ... 4
- Total current of power supply for digital outputs 5 ... 8

The device calculates the current load per output and adds a factor I^2 per time t.
The value can be read out as percentage ranging from 0 ... 100 %.

I²t calculation

The JCM-350-E01/E02 calculates the average power dissipation by the following formula:

$$x(t) = 100\,\% \cdot \left(\frac{avg_I}{nom_I}\right)^2 \cdot \left(1 - e^{-\frac{t}{T}}\right)$$

Variable	Description
x(t)	Proportional value of average power dissipation in per cent (0 ... 100 %)
avg_I	Average current
nom_I	Rated current
t	Elapsed time
T	Time constant

Output	Parameter	Description
H-bridge	Rated current nom_I Time constant	I = 16 A T = 13.9 s
Digital output	Rated current nom_I Time constant	I = 8 A T = 13.9 s
Total current - digital outputs 1 ... 4	Rated current nom_I Time constant	I = 16 A T = 13.9 s
Total current - digital outputs 5 ... 8	Rated current nom_I Time constant	I = 16 A T = 13.9 s

t calculation

The following formula is used to calculate the time until the I^2t error message is triggered:

$$t = -T \cdot \ln\left[1 - \left(\frac{nom_I}{avg_I}\right)^2\right]$$

The above formula is applied if x(t) = 100 %.

Example

A motor is connected to the H-bridge. The motor's rated current is 16 A, its inrush current is 80 A (5 times the rated current).

Thus, the trip limit of 100 % will be reached after 560 ms.

Factors influencing the I^2t calculation

The percentage resulting from I^2t calculation may differ from the actual load for the following reasons:

- System restart: Following a restart the calculated heating-up value does no longer correspond to the actual load.
- Active cooling of JCM-350-E01/E02

The I^2t value is a **mathematically calculated indicator** showing to what extent the JCM-350-E01/E02 is loaded.

Digital outputs - I²t monitoring of H-bridges and power supply

Current limitation

The JCM-350-E01/E02 monitors the following outputs and limits their currents:

- H-bridge
- Total current of power supply for digital outputs 1 ... 4
- Total current of power supply for digital outputs 5 ... 8

The behavior of I²t monitoring is identical for these outputs.

Note on digital outputs

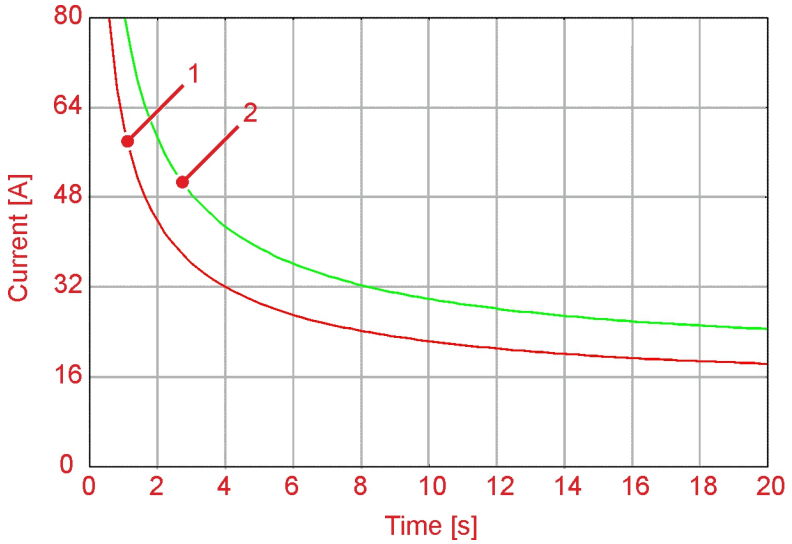
The total current of digital outputs 1 ... 4 must not exceed 16 A. The total current of digital outputs 5 ... 8 must not exceed 16 A. The maximum current of an individual output must not exceed 8 A.

The table below shows some possible combinations for digital outputs 1 ... 4:

Total current	Current value	Output
16 A	8 A	Digital output 1
	4 A	Digital output 2
	2 A	Digital output 3
	2 A	Digital output 4
16 A	0 A	Digital output 1
	8 A	Digital output 2
	4 A	Digital output 3
	4 A	Digital output 4
16 A	0 A	Digital output 1
	8 A	Digital output 2
	8 A	Digital output 3
	0 A	Digital output 4
16 A	4 A	Digital output 1
	4 A	Digital output 2
	4 A	Digital output 3
	4 A	Digital output 4

I^2t monitoring

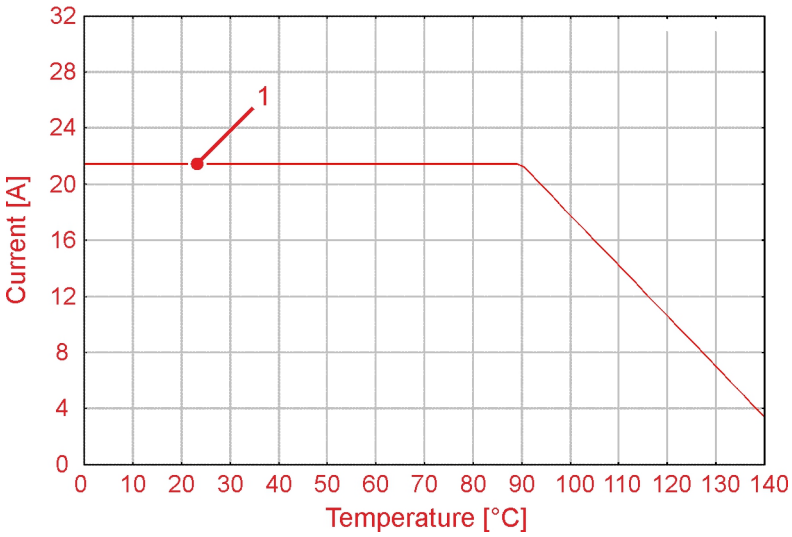
I²t monitoring keeps track of the current delivered to the digital outputs and H-bridges. If the current delivered per unit of time exceeds the limit, the JCM-350-E01/E02 disables the corresponding outputs. The controller lets you read out the I^2t value to keep track of load and temperature. You can define corrective actions to be taken if one of these values exceeds its limit, e. g. cut off the load. The diagram below shows the maximum current that is allowed to flow per time t.



Number	Description
1	I²t curve for a rated current of 16 A and an internal temperature of the device of 105 °C.
2	I²t curve for a rated current of 21.4 A and an internal temperature of the device of 90 °C.

Equivalent current

For information on maximum loading on the device refer to the diagram below:



Number	Description
1	Up to a temperature of 90 °C inside the device the continuous rated output current is 21.4 A; if the temperature exceeds 90°C, the output current is derated accordingly.

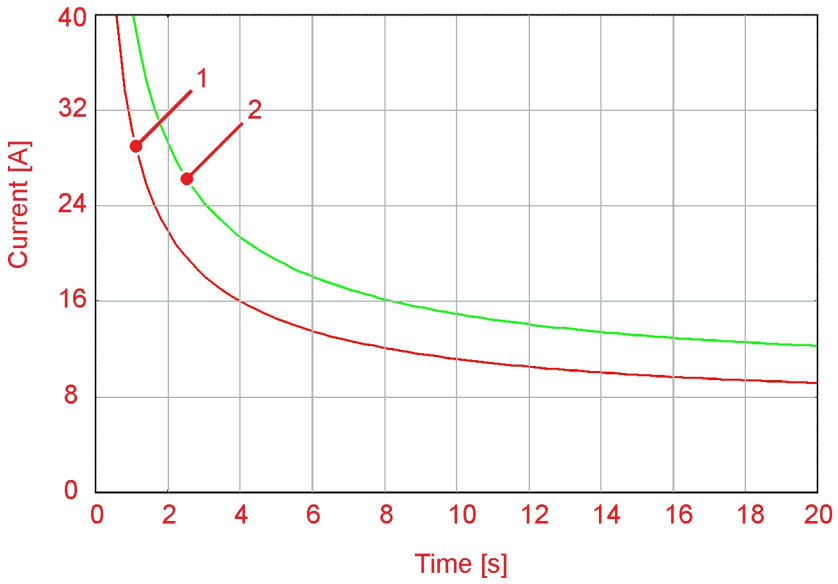
I²t monitoring of digital outputs

Current limitation

The controller JCM-350-E01/E02 monitors and limits the current of digital outputs 1 ... 8.

I^2t monitoring

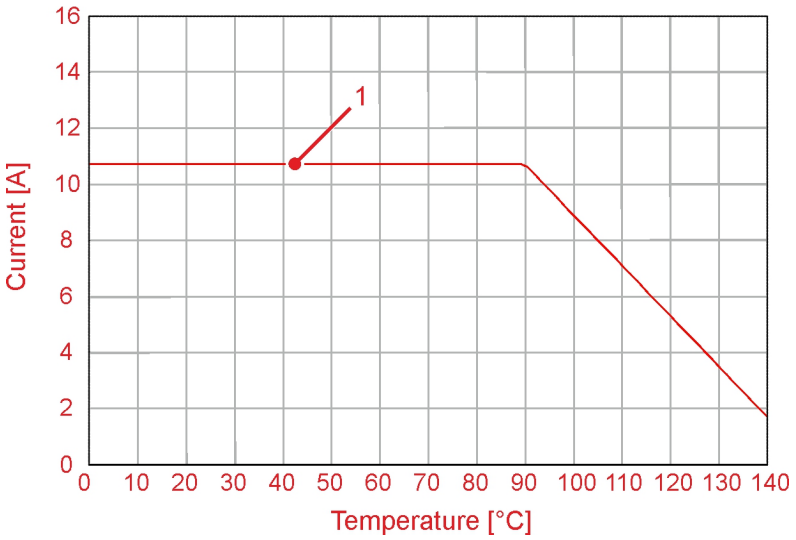
If the current delivered per unit of time exceeds the limit, the JCM-350-E01/E02 disables the digital outputs. The controller lets you read out the I^2t value to keep track of load and temperature. You can define corrective actions to be taken if one of these values exceeds its limit, e. g. cut off the load. The diagram below shows the maximum current of the digital outputs that is allowed to flow per time t:



Number	Description
1	I²t curve for a rated current of 8 A and an internal temperature of the device of 105 °C.
2	I²t curve for a rated current of 10.7 A and an internal temperature of the device of 90 °C.

Equivalent total current of digital outputs

For information on maximum loading on the device resulting from digital outputs refer to the diagram below:



Number	Description
1	Up to a temperature of 90 °C inside the device the continuous rated output current is 10.7 A; If the temperature inside the device exceeds 90 °C, the output current is derated accordingly.

5 Initial commissioning

Purpose of this chapter

This chapter provides a compact description on how to commission the JCM-350-E01/E02 and covers the following functions:

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Preparatory work for initial commissioning	90
Initial Commissioning in JetSym	92
Enabling the device in the application program	98

Preparatory work for initial commissioning

Introduction

To be able to commission and program the JCM-350-E01/E02, complete the following activities first:

- Wire up the power supply units, ignition and CAN interface
- Connect a USB/CAN adaptor between controller and PC. Install the driver software for the given adaptor.

In order to commission the JCM-350-E01/E02, you don't have to connect any peripheral devices to it.

Default values of JCM-350

The default values of the JCM-350-E01/E02 are listed below:

- CAN BAUD rate: 250 kBaud
- CANopen® Node-ID: 0x7F

Wiring the Controller

To wire the controller JCM-350-E01/E02, proceed as follows:

Step	Action
1	Connect X110, X118, X119, X210, X218, X219 to the power supply DC 7.5 V ... DC 32 V: ■ Ignition (terminal 15 in the vehicle's electrical system) ■ Power supply (terminal 30 in the vehicle's electrical system) ■ Ground (terminal 31 in the vehicle's electrical system)
2	Connect a CAN connector to your PC using a CAN adaptor.
⇨	Now you controller is ready to be programmed from the PC.

Note

The device JCM-350-E01/E02 is not equipped with an internal (activatable) terminating resistor for the CAN bus.

Make sure that there is a terminating resistor of 120 Ω at both ends of the CAN bus.

Supported USB/CAN adaptors

The following USB/CAN adaptors are supported by the programming tool JetSym:

- **IXXAT Automation GmbH** (**http://www.ixxat.de http://www.ixxat.de**): For a list of currently supported hardware refer to the website of IXXAT Automation GmbH.
  We support the following driver versions: VCI version 3.3, and VCI version 2.18
- **PEAK-System Technik GmbH** (**http://www.peak-system.com http://www.peak-system.com**): For a list of currently supported hardware refer to the website of PEAK-System Technik GmbH.
  We support the following driver versions: Version 3.5.4.9547 or higher

Installing the USB CAN adaptor

Prerequisites:

Before installing the USB CAN adaptor, **JetSym 4.3** or higher must be installed on the PC to be used.

To install the adaptor proceed as follows:

Step	Action	
1	Insert the USB CAN adaptor into a USB port of your PC.	
2	If the Hardware Wizard opens, close it.	
3	Install the driver for the USB CAN adaptor.	
4	Install the corresponding JetSym driver depending on the USB CAN adaptor used.	
	If ...	**... then ...**
	... you use an adaptor by PEAK-Systems	... proceed with step 5.
	... you do not use an adaptor by PEAK-Systems	... proceed with step 7.
5	Navigate in Windows Explorer to the directory **PcanDrv** located in the JetSym installation. Default location: **C:\Programme\Jetter\JetSym\Tools\PcanDrv**	
6	Execute the file **PcanDrv.exe**. Follow the steps of the installation routine.	
7	Plug the Sub-D connector of the adaptor into the IN_CAN port of the JCM-350-E01/E02 (female Sub-D connector).	

Result: In the case of an error-free installation the CANopen® connection between PC and controller is established.

Behavior after power-up

Simultaneously pressing function keys F1 and F6 on the JCM-350-E01/E02 during power-up will prevent the application program from being launched.

Related topics

- **Power Supply of the Device** (see page 50)
- **Initial Commissioning in JetSym** (see page 92)

Initial Commissioning in JetSym

Introduction

JetSym lets you configure and program the controller JCM-350-E01/E02 This chapter covers the following topics:

- Creating a project in JetSym
- Configuring the hardware/controller
- Initializing the JCM-350-E01/E02

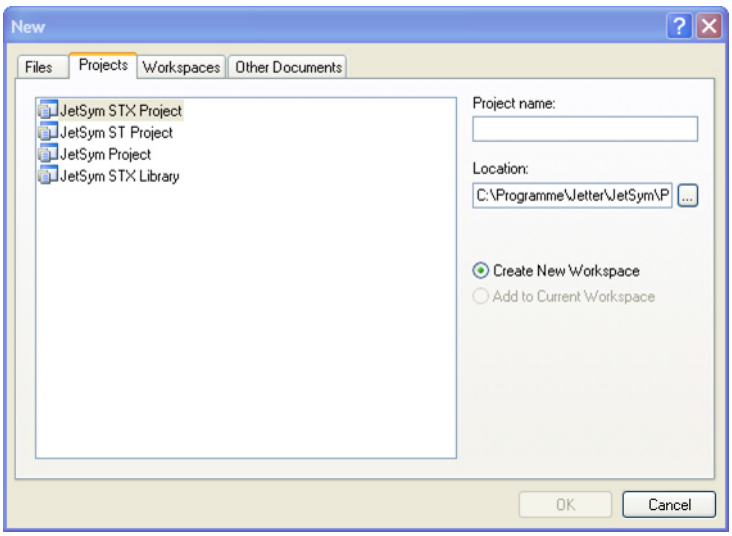
Prerequisites

The following requirements must be met:

- JetSym is installed on the PC used.
- JetSym has been licensed (see online help in JetSym).
- Preparatory work for initial commissioning is completed.
- An active CANopen® connection between controller and PC has been established. For establishing this connection use, for instance, a CAN/USB adaptor. Jetter AG have tested adaptors by PEAK-System.

Creating a Project

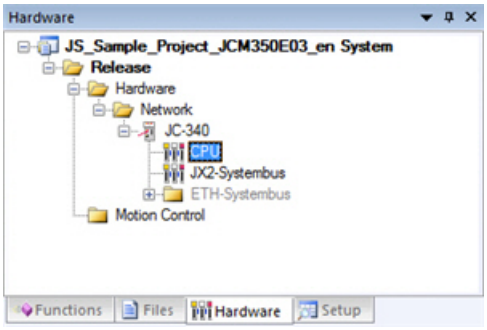
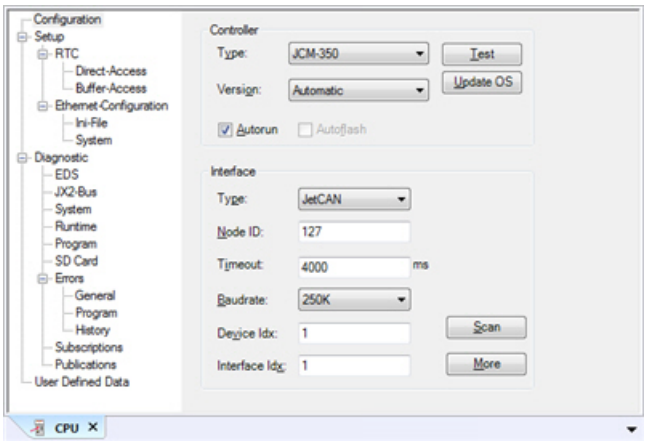
A new project for the programming is created in JetSym as follows:

Step	Action
1	Start JetSym.
2	Open the menu **File**. Select menu item **New**. **Result:** The dialog box **New** opens. 
3	Select **JetSym STX project** as the project type.
4	Enter the project name.
5	Confirm your settings by clicking **OK**.

Result: Creation of the project is completed.

Configuring the Hardware

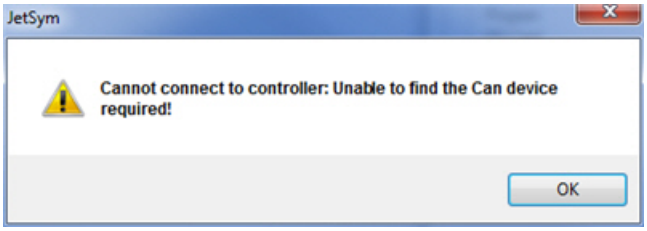
To establish a connection between JetSym and the controller, you must configure the hardware:

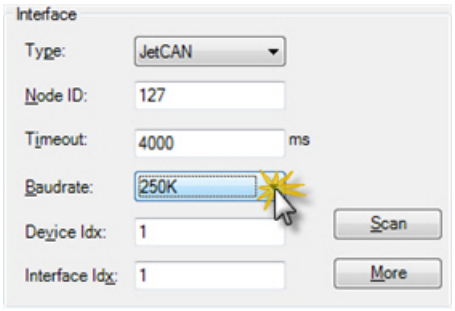
Step	Action
1	Switch to the **Hardware** view by clicking on the tab with the same name. 
2	Fully expand the **Hardware tree**.
3	Double-click on **CPU**. **Result:** The dialog box **Configuration** opens. 
4	Under **Controller/Type** select **JCM-350**.
5	Under **Interface/Type** select **JetCAN**.
6	Test the connection to the controller by pressing the button **Test**. If the test fails, check the mechanical CAN connection between PC and JCM-350-E01/E02 (refer to the next topic "Possible Error Messages").
7	Save your settings using the shortcut **Ctrl + S**.

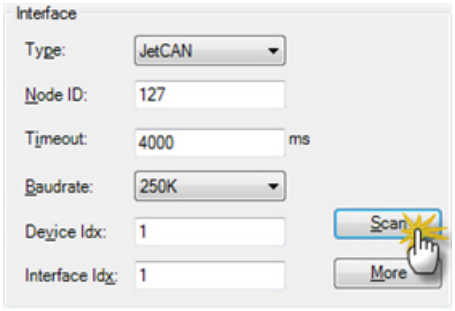
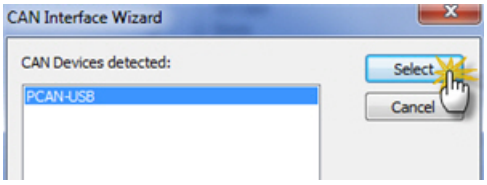
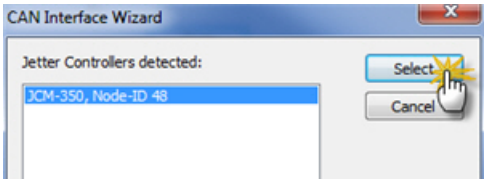
Result: The hardware settings are configured in JetSym.

Possible Error Messages

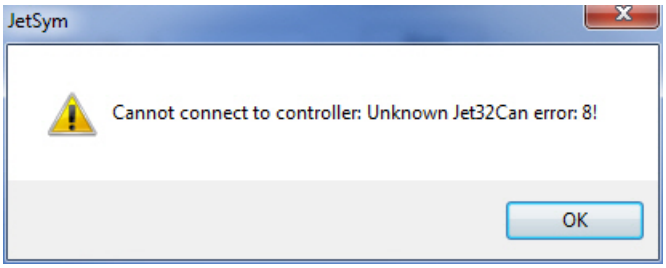
Error message # 1:

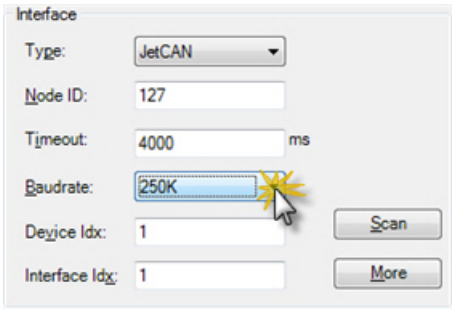


Possible cause	Fix for this Problem
Selection of wrong controller type	Check whether your selection matches the controller type. If it does not match the type, open the configuration dialog and re-select the controller.
Wrong Baud rate	Check whether a Baud rate of 250 kBaud is set. If not, set it to 250 kBaud. 

Possible cause	Fix for this Problem
Wrong node ID	If you don't know the node ID of your controller, scan the CAN bus for nodes:  Select the hardware that has been found as a result of the scan:  Select the controller that has been found as a result of the scan:  **Result:** The node ID of the controller is automatically entered into the corresponding box of the configuration mask.

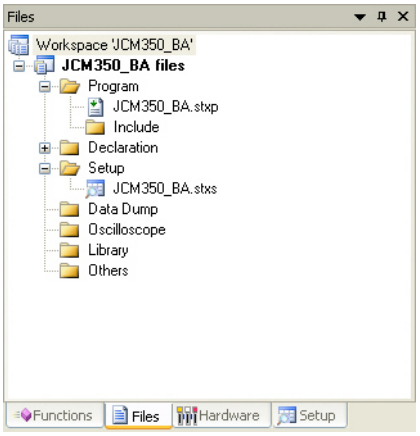
Error message # 2:



Possible cause	Fix for this Problem
Wrong Baud rate	Check whether a Baud rate of 250 kBaud is set. Where necessary, restart JetSym. Enter the correct Baud rate. Test the connection to the controller again.  **Note:** If this error message is displayed after the restart of JetSym, re-boot your PC.

Initializing the JCM-350-E01/E02

To create an executable program for initializing the JCM-350-E01/E02, proceed as follows:

Step	Action
1	Switch to **Files** view. 
2	Double-click on the program file (in our example **JCM350_BA.stxp)**. The program file has the same name as the project, plus the extension **stxp**. **Result:** The program file opens in JetSym editor.

3	Enter the following program code:
	`Var`
	`  Result: Int at %VL 1000000;`
	`End_Var;`
	
	`Task Main Autorun`
	`  Result := CanOpenInit(0, 127, 'Version: 01.00.0.00');`
	`End_Task;`

4	Press the **F7** key to trigger a project build. **Result:** A program which will run on the controller.
5	Press the shortcut **CTRL+F5**. **Result:** The program has been uploaded to the controller.

Result:

The program can now be enhanced. In **IntelliSense** (**Ctrl + Space Bar**), the CANopen® functions are now available.

Enabling the device in the application program

Introduction

After power-up the JCM-350-E01/E02 is ready for operation. The peripheral connections, such as digital outputs, are not yet active.

You must enable the device in the application program.

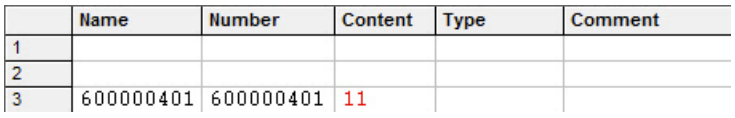
Prerequisites

The following requirements must be met:

- The JCM-350-E01/E02 is connected to a power supply unit.
- The device is connected to the PC via CANopen® interface.
- A JetSym project is open or has been created.

Commissioning from within the application program

To commission the JCM-350-E01/E02, proceed as follows:

Step	Action
1	In the tree structure **Files** open a setup pane.
2	Enter the value 11 into R 600000401: 
⇨	Communication for I/O module 1 is enabled. The setup pane lets you access all registers on I/O module 1. To enable I/O module 2, enter the value 12 into R 600000401. This enabling procedure applies only to JCM-350-E02.

	Name	Number	Content	Type	Comment
1					
2					
3	600000401	600000401	11		

Related topics

- **Initial Commissioning in JetSym** (see page 92)
- **Status and Instructions** (see page 169)

6 CANopen® STX API

Introduction

This chapter describes the STX functions of the CANopen® STX API.

The CANopen® standard

CANopen® is an open standard for networking and communication, for instance, in the automobile sector.

The CANopen® protocol has been further developed by the CiA e.V. (CAN in Automation) and works on the physical layer with CAN Highspeed in accordance with ISO 11898.

Documentation

The CANopen® specifications can be obtained from the **CiA e.V. http://www.can-cia.org** homepage. The key specification documents are:

- CiA DS 301 - This document is also known as the communication profile and describes the fundamental services and protocols used under CANopen®.
- CiA DS 302 - Framework for programmable devices (CANopen® Manager, SDO Manager)
- CiA DR 303 - Information on cables and connectors
- CiA DS 4xx - These documents describe the behavior of a number of device classes in, what are known as, device profiles.

Application

These STX functions are used in communication between the JCM-350-E01/E02 and other CANopen® nodes.

Note: Take into account the point of view!

In this chapter we use the point of view from the higher-level controller, whereas in the document CiA DS 301 the point of view from the devices is used.

This is why you need, for example, a PDO-RX macro to invoke the function **CanOpenAddPDORx()**.

Terms and abbreviations:

In this chapter, the following terms and abbreviations are used:

Term	Description
Node ID	Node identification number of the device: This ID lets you address the device.
ro	Read only access
rw	Read/write access

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STX Function CanOpenInit

Introduction

The function `CanOpenInit()` lets you initialize one of the CAN busses. The JCM-350-E01/E02 then automatically sends the heartbeat message every second with the following communication object identifier (COB-ID): Node ID + 0x700.

Function declaration

```
Function CanOpenInit(
    CANNo:Int,
    NodeID:Int,
    const ref SWVersion:String,
) :Int;
```

Function parameters

The function `CanOpenInit()` has got the following parameters.

Parameter	Description	Value
CANNo	CAN bus number	0 ... CANMAX
NodeID	Own node ID	1 ... 127
SWVersion	Reference to own software version This software version is entered into the index 0x100A in the object directory.	String up to 255 characters

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters
-3	Initialization has not worked

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	0
JCM-350	4
JCM-620	2
JVM-104	0
JVM-407	2
JVM-407B	2

How to use this function

Initializing the CAN-Bus 0. The JCM-350-E01/E02 has Node-ID 20 (0x14).

```
Result := CanOpenInit(0, 20, 'Version: 01.00.0.00');
```

Operating principle

During initialization, the JCM-350-E01/E02 processes the following process steps:

Level	Description
1	First, the bootup message is sent as a heartbeat message.
2	As soon as the JCM-350-E01/E02 goes into preoperational status, it sends the heartbeat message "preoperational".

Access to the object directory

If the JCM-350-E01/E02 is in "preoperational" state, it lets you access the object directory using SDO.

NMT messages

After initialization, NMT messages can be sent and received. The own heartbeat status can be changed with the function `CanOpenSetCommand`.

Related topics

- **STX Function CanOpenSetCommand** (see page 103)

STX Function CanOpenSetCommand

Introduction

The function `CanOpenSetCommand()` lets you change the own heartbeat status and the heartbeat status for all other devices (NMT slaves) on the CAN bus.

Function declaration

```
Function CanOpenSetCommand(
    CANNo:Int,
    iType:Int,
    Value:Int,
) :Int;
```

Function parameters

The function `CanOpenSetCommand()` has got the following parameters.

Parameter	Description	Value
CANNo	CAN bus number	0 ... CANMAX
iType	Command selection	See table below.

iType	Description: Value
CAN_CMD_HEARTBEAT	Only the own heartbeat status is changed. Selecting heartbeat states: CAN_HEARTBEAT_STOPPED (0x04) CAN_HEARTBEAT_OPERATIONAL (0x05) CAN_HEARTBEAT_PREOPERATIONAL (0x7F)
CAN_CMD_NMT	The heartbeat status is changed for all other devices or for a specific device on the CAN bus. Selecting heartbeat states (NMT master): CAN_NMT_OPERATIONAL (0x01) or CAN_NMT_START (0x01) CAN_NMT_STOP (0x02) CAN_NMT_PREOPERATIONAL (0x80) CAN_NMT_RESET (0x81) CAN_NMT_RESETCOMMUNICATION (0x82)
CAN_CMD_TIME_CONSUMER	This command lets you set the device to ready-to-receive state to allow time synchronization via CAN bus (CAN ID 0x100). Refer to document by CiA e.V. DS301 V402, page 59. Enabling/disabling synchronization: CAN_TIME_CONSUMER_DISABLE = 0 CAN_TIME_CONSUMER_ENABLE = 1
CAN_CMD_TIME_PRODUCER	The time is published on the CAN bus. For more information on structure refer to document DS301 by CiA e.V., CAN ID 0x100: CAN_TIME_PRODUCER_SEND = 1 (for sending TIME_OF_DAY once)

Note

The command CAN_CMD_NMT is selected via the macro function CAN_CMD_NMT_Value(NodeID, CAN_CMD_NMT).

Values from 0 to 127 are permitted for the node ID parameter. 1 to 127 is the node ID for a specific device. If the command is to be sent to all devices on the CAN bus, use the parameter CAN_CMD_NMT_ALLNODES(0).

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	0
JCM-350	4
JCM-620	2
JVM-104	0
JVM-407	2
JVM-407B	2

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters Command not known

How to use this function (example 1)

Task: Set the own heartbeat status to Operational.

```
Result := CanOpenSetCommand(0, CAN_CMD_HEARTBEAT,
CAN_HEARTBEAT_OPERATIONAL);
```

How to use this function (example 2)

Task: Set the own heartbeat status and the status of all other devices on the CAN bus to Operational.

```
Result := CanOpenSetCommand(0,
CAN_CMD_NMT_Value(CAN_CMD_NMT_ALLNODES, CAN_CMD_NMT),
CAN_NMT_OPERATIONAL);
```

How to use this function (example 3)

Task: Set the heartbeat status of the device with the node ID 60 (0x3C) to Operational.

```
Result := CanOpenSetCommand(0, CAN_CMD_NMT_Value(60, CAN_CMD_NMT),
CAN_NMT_OPERATIONAL);
```

How to use this function (example 4)	Task: Enable time synchronization via CAN bus (CAN ID 0x100). `Result := CanOpenSetCommand(0, CAN_CMD_HEARTBEAT, CAN_HEARTBEAT_OPERATIONAL);`
How to use this function (example 5)	Task: Publish the time on the CAN bus. `Result := CanOpenSetCommand(0, CAN_CMD_HEARTBEAT, CAN_HEARTBEAT_OPERATIONAL);`

STX Function CanOpenUploadSDO

Introduction

The function `CanOpenUploadSDO()` lets you access a particular object in the Object Directory of the message recipient and read the value of the object. Data is exchanged in accordance with the SDO upload protocol. Supported transfer types are "segmented" (more than 4 data bytes) and "expedited" (up to 4 data bytes).

Function declaration

```
Function CanOpenUploadSDO (
    CANNo:Int,            // Number of the bus line
    NodeID:Int,            // Node ID
    wIndex:Word,
    SubIndex:Byte,
    DataType:Int,         // Type of the data to be received
    // Volume of data for the global variable DataAddr
    DataLength:Int,
    // Global variable holding the received value
    const ref DataAddr,
    ref Busy: Int,         // Status or the SDO transmission
) :Int;
```

Function parameters

The `CanOpenUploadSDO()` function has got the following parameters.

Parameter	Description	Value
CANNo	CAN bus number	0 ... CANMAX
NodeID	Node ID of the message recipient	1 ... 127
wIndex	Index number of the object	0 ... 0xFFFF
SubIndex	Sub-index number of the object	0 ... 255
DataType	Type of data to be received	2 ... 27
DataLength	Volume of data for the global variable DataAddr	
DataAddr	Global variable into which the received value is to be entered	
Busy	Status of the SDO transmission	

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error in checking parameters
-2	Device in Stop status
-3	DataType is greater than DataLength
-4	Insufficient memory

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	0
JCM-350	4
JCM-620	2
JVM-104	0
JVM-407	2
JVM-407B	2

Parameter DataType

The following data types can be received.

Byte types	CANopen® format	Jetter format
1	CANOPEN_INTEGER8 CANOPEN_UNSIGNED8	Byte
2	CANOPEN_INTEGER16 CANOPEN_UNSIGNED16	Word
3	CANOPEN_INTEGER24 CANOPEN_UNSIGNED24	-
4	CANOPEN_INTEGER32 CANOPEN_UNSIGNED32 CANOPEN_REAL	Int
5	CANOPEN_INTEGER40 CANOPEN_UNSIGNED40	-
6	CANOPEN_INTEGER48 CANOPEN_UNSIGNED48 CANOPEN_TIME_OF_DAY CANOPEN_TIME_DIFFERENCE	-
7	CANOPEN_INTEGER56 CANOPEN_UNSIGNED46	-
8	CANOPEN_INTEGER64 CANOPEN_UNSIGNED64 CANOPEN_REAL64	-
n	CANOPEN_VISIBLE_STRING CANOPEN_OCTET_STRING CANOPEN_UNICODE_STRING CANOPEN_DOMAIN	String

Busy

After calling up the function, the Busy parameter is set to SDOACCESS_INUSE. With an error in transmission, Busy is set to SDOACCESS_ERROR. With a successful transmission, the number of bytes transmitted is returned.

"Busy" Error Codes

With an error in transmission, Busy returns an error code. The following error codes are available:

SDOACCESS_STILLUSED

Another task is communicating with the same node ID.

SDOACCESS_TIMEOUT

The task has been timed out because the device with the specified node ID is not responding.

If the specified node ID does not respond within 1 second, the timeout bit is set.

SDOACCESS_ILLCMD

The response to the request is invalid.

SDOACCESS_ABORT

Access to the device with the specified node ID was aborted.

SDOACCESS_SYSERROR

General internal error

Macro Definitions

The following macros have been defined in connection with this function:

SDOACCESS_FINISHED (busy)

This macro checks whether communication has finished.

SDOACCESS_ERROR (busy)

This macro checks whether an error has occurred.

How to use this function

```
Result := CanOpenUploadSDO(
    0,                          // CANNo
    66,                         // NodeID
    0x100A,                     // wIndex
    0,                          // SubIndex
    CANOPEN_STRING,             // DataType
    sizeof(var_Versionstring),  // DataLength
    var_Versionstring,          // DataAddr
    busy);                      // Busy
```

JetSym STX program

In the following example, the manufacturer's software version is read from the CANopen® Object Directory of the device with the addressed node ID.

```
Const
    CANNo = 0;         // Number of the bus line
    NodeID_Node_0 = 10;    // Device ID of node 1
    NodeID_Node_1 = 66;    // Device ID of node 2
End_Const;

Var
    busy: Int;
    Version string: String;
    Objectindex: Word;
    Subindex: Byte;
End_Var;


Task main autorun

Var
    SW_Version: String;
End_Var;

SW_Version := 'v4.3.0.2004';

// Initializing CAN 0
CanOpenInit(CANNo,             // Number of the bus line
            NodeID_Node_0,     // Node ID
            SW_Version);       // Manufacturer's software version

// All devices on the CAN bus have the status of PREOPERATIONAL

// Request manufacturer's software version per SDO
Objectindex := 0x100A;
Subindex := 0;
CanOpenUploadSDO(CANNo,            // Number of the bus line
                 NodeID_Node_1,          // Node ID
                 Objectindex,            // wIndex
                 Subindex,               // SubIndex
                 CANOPEN_STRING,         // DataType
                 sizeof(Versionstring),  // DataLength
                 Versionstring,          // DataAddr
                 busy);                  // Busy

// Waiting until communication is completed
When SDOACCESS_FINISHED(busy) Continue;

// Checking for errors
If (SDOACCESS_ERROR(busy)) Then
// Troubleshooting
```

```
End_If;

//      ...
//      ...
//      ...

End_Task;
```

STX Function CanOpenDownloadSDO

Introduction

The function `CanOpenDownloadSDO()` lets you access a particular object in the Object Directory of the message recipient and specify the value of the object. Data is exchanged in accordance with the SDO upload protocol. Supported transfer types are "segmented" or "block" (more than 4 data bytes) and "expedited" (up to 4 data bytes).

Function declaration

```
Function CanOpenDownloadSDO(
    CANNo:Int,              // Number of the bus line
    NodeID:Int,             // Node ID
    wIndex:Word,
    SubIndex:Byte,
    DataType:Int,           // Type of the data to be sent
    // Volume of data for the global variable DataAddr
    DataLength:Int,
    // Global variable holding the value to be sent
    const ref DataAddr,
    ref Busy: Int,          // Status or the SDO transmission
) :Int;
```

Function parameters

The CanOpenDownloadSDO() function has got the following parameters.

Parameter	Description	Value
CANNo	CAN bus number	0 ... CANMAX
NodeID	Node ID of the message recipient	1 ... 127
wIndex	Index number of the object	0 ... 0xFFFF
SubIndex	Sub-index number of the object	0 ... 255
DataType	Type of data to be sent	2 ... 27
DataLength	Volume of data for the global variable DataAddr	
DataAddr	Global variable into which the value to be sent is to be entered	
Busy	Status of the SDO transmission	

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters
-2	Device in Stop status (own heartbeat status)
-3	DataType is greater than DataLength
-4	Insufficient memory

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	0
JCM-350	4
JCM-620	2
JVM-104	0
JVM-407	2
JVM-407B	2

Parameter DataType

The following data types can be received.

Byte types	CANopen® format	Jetter format
1	CANOPEN_INTEGER8 CANOPEN_UNSIGNED8	Byte
2	CANOPEN_INTEGER16 CANOPEN_UNSIGNED16	Word
3	CANOPEN_INTEGER24 CANOPEN_UNSIGNED24	-
4	CANOPEN_INTEGER32 CANOPEN_UNSIGNED32 CANOPEN_REAL	Int
5	CANOPEN_INTEGER40 CANOPEN_UNSIGNED40	-
6	CANOPEN_INTEGER48 CANOPEN_UNSIGNED48 CANOPEN_TIME_OF_DAY CANOPEN_TIME_DIFFERENCE	-
7	CANOPEN_INTEGER56 CANOPEN_UNSIGNED46	-
8	CANOPEN_INTEGER64 CANOPEN_UNSIGNED64 CANOPEN_REAL64	-
n	CANOPEN_VISIBLE_STRING CANOPEN_OCTET_STRING CANOPEN_UNICODE_STRING CANOPEN_DOMAIN	String

Busy

After calling up the function, the Busy parameter is set to SDOACCESS_INUSE. With an error in transmission, Busy is set to SDOACCESS_ERROR. With a successful transmission, the number of bytes transmitted is returned.

"Busy" Error Codes

With an error in transmission, Busy returns an error code. The following error codes are available:

SDOACCESS_STILLUSED

Another task is communicating with the same node ID.

SDOACCESS_TIMEOUT

The task has been timed out because the device with the given node ID is not responding.

If the specified node ID does not respond within 1 second, the timeout bit is set.

SDOACCESS_ILLCMD

The response to the request is invalid.

SDOACCESS_ABORT

Access to the device with the specified node ID was aborted.

SDOACCESS_BLKSIZEINV

Communication error with Block Download

SDOACCESS_SYSERROR

General internal error

Macro Definitions

The following macros have been defined in connection with this function:

SDOACCESS_FINISHED (busy)

This macro checks whether communication has finished.

SDOACCESS_ERROR (busy)

This macro checks whether an error has occurred.

How to use this function

```
Result := CanOpenDownloadSDO(
    0,                              // CANNo
    68,                             // NodeID
    0x1017,                          // wIndex
    0,                              // SubIndex
    CANOPEN_WORD,                    // DataType
    sizeof(var_Heartbeat_time),     // DataLength
    var_Heartbeat_time,              // DataAddr
    busy);                          // Busy
```

JetSym STX program

In the following example, the heartbeat time is entered in the CANopen® Object Directory of the device with the addressed node ID.

```
Const
    CANNo = 0;              // Number of the bus line
    NodeID_Node_0 = 10;     // Node ID of node 1
    NodeID_Node_0 = 68;     // Node ID of node 2
End_Const;

Var
    busy: Int;
    Heartbeat_time: Int;
    Objectindex: Word;
    Subindex: Byte;
End_Var;


Task main autorun

Var
    SW_Version: String;
End_Var;

SW_Version := 'v4.3.0.2004';

// Initializing CAN 0
CanOpenInit(CANNo,             // Number of the bus line
            NodeID_Node_0,     // Node ID
            SW_Version);       // Manufacturer's software version

// Setting the node with ID NodeID_Node_1 on the CAN bus to
// PREOPERATIONAL status
CanOpenSetCommand(CANNo, CAN_CMD_NMT_Value(NodeID_Node_1,
CAN_CMD_NMT), CAN_NMT_PREOPERATIONAL);

// Changing the heartbeat time of the addressed device via SDO
Objectindex := 0x1017;
Subindex := 0;
CanOpenDownloadSDO(CANNo,             // Number of the bus line
                   NodeID_Node_1,          // Node ID
                   Objectindex,            // wIndex
                   Subindex,               // SubIndex
                     CANOPEN_WORD,            // DataType
                     sizeof(Heartbeat_time),  // DataLength
                     Heartbeat_time,          // DataAddr
                     busy);                   // Busy

// Waiting until communication is completed
When SDOACCESS_FINISHED(busy) Continue;
```

```
// Checking for errors
If (SDOACCESS_ERROR(busy)) Then
// Troubleshooting
End_If;

// Resetting all devices on the CAN bus to OPERATIONAL status
CanOpenSetCommand(CANNo, CAN_CMD_NMT_Value(CAN_CMD_NMT_ALLNODES,
CAN_CMD_NMT), CAN_NMT_OPERATIONAL);

//      ...
//      ...
//      ...

End_Task;
```

STX function CanOpenAddPDORx

Introduction

By calling up the `CanOpenAddPDORx()` function, process data, sent by other CANopen® devices, can be entered on receipt.

Process data can be received only when a CANopen® device is sending them.

Notes

- Only if the CANopen® devices on the bus are in state "operational", the PDO telegram is transmitted.
- The smallest time unit for the Event Time is 1 ms.
- The smallest time unit for the Inhibit Time is 1 ms.

Function declaration

```
Function CanOpenAddPDORx(
    CANNo:Int,           // Number of the bus line
    CANID:Int,           // CAN identifier
    // Starting position of the data to be received
    BytePos:Int,
    DataType:Int,        // Data type of the data to be received
    // Volume of data for the global variable VarAddr
    DataLength:Int,
    // Global variable holding the received value
    const ref VarAddr,
    // Cycle time for receiving telegrams (Event Time)
    EventTime: Int,
    // Minimum time lag between two telegrams received
    // (Inhibit Time)
    InhibitTime: Int,
    Paramset: Int,       // Bit-coded parameter
) :Int;
```

Function parameters

The `CanOpenAddPDORx()` function has got the following parameters:

Parameter	Description	Value
CANNo	CAN bus number	0 ... CANMAX
CANID	CAN identifier 11-bit CAN identifier 29-bit	0 ... 0x7FF 0 ... 0x1FFFFFFF
BytePos	Starting position of data to be received	0 ... 7
DataType	Data type of data to be received	2 ... 13, 15 ... 27
DataLength	Volume of data for the global variable VarAddr	
VarAddr	Global variable into which the received value is entered	
EventTime	Time lag between two telegrams (> Inhibit Time)	
InhibitTime	Minimum time lag between two telegrams received (< EventTime)	

Parameter	Description	Value
Paramset	Bit-coded parameter	

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters
-3	DataType is greater than DataLength
-4	Insufficient memory

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	0
JCM-350	4
JCM-620	2
JVM-104	0
JVM-407	2
JVM-407B	2

Note: Take into account the point of view!

In this chapter we use the point of view from the higher-level controller, whereas in the document CiA DS 301 the point of view from the devices is used.

This is why you need a PDO-RX macro to invoke the function `CanOpenAddPDORx()` from the controller.

Parameter CANID

The CANID parameter is used to transfer the CAN identifier. The CAN identifier is generated with a macro. The CAN identifier depends on the node ID of the other communicating user and on whether it is a PDO1, PDO2, PDO3 or PDO4 message.

Macro definitions:

```
#Define CANOPEN_PDO1_RX (NodeID)     ((NodeID) + 0x180)
#Define CANOPEN_PDO2_RX (NodeID)     ((NodeID) + 0x280)
#Define CANOPEN_PDO3_RX (NodeID)     ((NodeID) + 0x380)
#Define CANOPEN_PDO4_RX (NodeID)     ((NodeID) + 0x480)

#Define CANOPEN_PDO1_TX (NodeID)     ((NodeID) + 0x200)
#Define CANOPEN_PDO2_TX (NodeID)     ((NodeID) + 0x300)
#Define CANOPEN_PDO3_TX (NodeID)     ((NodeID) + 0x400)
#Define CANOPEN_PDO4_TX (NodeID)     ((NodeID) + 0x500)
```

Example for calling up the macro:

CANOPEN_PDO2_RX (64)

⇨ The resulting CAN identifier is: 2C0h = 40h + 280h

Default CAN Identifier Distribution

For CANopen® the following CAN identifier distribution is predefined. In this case, the node number is embedded in the identifier.

11-bit identifier (binary)	Identifier (decimal)	Identifier (hexadecimal	Description
000000000000	0	0	Network Management
000100000000	128	80h	Synchronization
0001xxxxxxxx	129 - 255	81h - FFh	Emergency
0011xxxxxxxx	385 - 511	181h - 1FFh	PDO1 (tx)
0100xxxxxxxx	513 - 639	201h - 27Fh	PDO1 (rx)
0101xxxxxxxx	641 - 767	281h - 2FFh	PDO2 (tx)
0110xxxxxxxx	769 - 895	301h - 37Fh	PDO2 (rx)
0111xxxxxxxx	897 - 1023	381h - 3FFh	PDO3 (tx)
1000xxxxxxxx	1025 - 1151	401h -47Fh	PDO3 (rx)
1001xxxxxxxx	1153 - 1279	481h - 4FFh	PDO4 (tx)
1010xxxxxxxx	1281 - 1407	501h - 57Fh	PDO4 (rx)
1011xxxxxxxx	1409 - 1535	581h - 5FFh	Send SDO
1100xxxxxxxx	1537 - 1663	601h - 67Fh	Receive SDO
1110xxxxxxxx	1793 - 1919	701h - 77Fh	NMT Error Control
xxxxxxxx = Node number 1 - 127			

Parameter DataType

The following data types can be received.

Byte types	CANopen® format	Jetter format
1	CANOPEN_INTEGER8 CANOPEN_UNSIGNED8	Byte
2	CANOPEN_INTEGER16 CANOPEN_UNSIGNED16	Word
3	CANOPEN_INTEGER24 CANOPEN_UNSIGNED24	-
4	CANOPEN_INTEGER32 CANOPEN_UNSIGNED32 CANOPEN_REAL	Int
5	CANOPEN_INTEGER40 CANOPEN_UNSIGNED40	-
6	CANOPEN_INTEGER48 CANOPEN_UNSIGNED48 CANOPEN_TIME_OF_DAY CANOPEN_TIME_DIFFERENCE	-
7	CANOPEN_INTEGER56 CANOPEN_UNSIGNED46	-
8	CANOPEN_INTEGER64 CANOPEN_UNSIGNED64 CANOPEN_REAL64	-
n	CANOPEN_VISIBLE_STRING CANOPEN_OCTET_STRING CANOPEN_UNICODE_STRING CANOPEN_DOMAIN	String

Parameter Paramset

The following parameters can be transferred to the function. Several parameters can be linked together using the Or function.

CANOPEN_ASYNCPDORTRONLY

Receive asynchronous PDOs by sending an RTR frame to the sender (after each expired EventTime). If there is no response to RTR frames, the request time increases to five times the EventTime.

CANOPEN_ASYNCPDO

Receive asynchronous PDOs.

CANOPEN_PDOINVALID

PDO not received. Disk space is reserved.

CANOPEN_NORTR

PDO cannot be requested by RTR (Remote Request).

Only if CANOPEN_ASYNCPDORTROnly has been set, an RTR is sent.

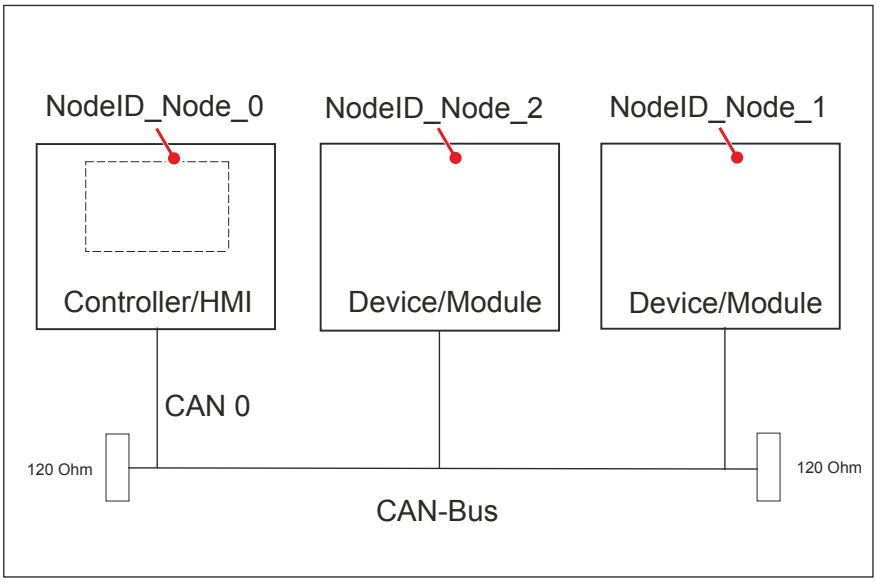
CANOPEN_29BIT
Use 29-bit identifier
Default: 11-bit identifier

How to use this function

```
Result := CanOpenAddPDORx(
    0,                                  // CANNo
    662,                                // CANID
    0,                                  // BytePos
    CANOPEN_DWORD,                      // DataType
    sizeof(var_Data_1_of_Node_1),       // DataLength
    var_Data_1_of_Node_1,               // VarAddr
    1000,                               // Event time
    10,                                 // Inhibit time
    CANOPEN_ASYNCPDO | CANOPEN_NORTR);  // Paramset
```

JetSym STX program

JCM-350-E01/E02 with node ID 10 wants to receive a PDO from two CANopen® devices with node ID 64 and 102. The function `CanOpenAddPDORx()` is called up for this purpose. After running the program, the JCM-350-E01/E02 receives cyclic PDO telegrams.




```
Const
    CANNo = 0;              // Number of the bus line
    NodeID_Node_0 = 10;     // Device ID of node 1
    NodeID_Node_1 = 64;     // Device ID of node 2
    NodeID_Node_2 = 102;     // Device ID of node 3
    Event_Time = 1000;      // Event time in ms
    Inhibit_Time = 10;      // Inhibit time in ms
End_Const;
```

```
Var
    Data_1_of_Node_1: Int;
    Data_2_of_Node_1: Int;
    Data_1_of_Node_2: Int;
End_Var;


Task main autorun

Var
    SW_Version: String;
End_Var;

SW_Version := 'v4.3.0.2004';

// Initializing CAN 0
CanOpenInit(CANNo,            // Number of the bus line
            NodeID_Node_0,    // Node ID
            SW_Version);      // Manufacturer's software version

// Entering process data to be sent
CanOpenAddPDORx(
    CANNo,                            // Number of the bus line
    CANOPEN_PDO2_RX(NodeID_Node_1),   // CANID
    0,                                // BytePos
    CANOPEN_DWORD,                    // DataType
    sizeof(Data_1_of_Node_1),         // DataLength
    Data_1_of_Node_1,                 // VarAddr
    Event_Time,                       // Event time
    Inhibit_Time,                     // Inhibit time
    CANOPEN_ASYNCPDORTRONLY);         // Paramset

CanOpenAddPDORx(
    CANNo,                            // Number of the bus line
    CANOPEN_PDO2_RX(NodeID_Node_1),   // CANID
    4,                                // BytePos
    CANOPEN_DWORD,                    // DataType
    sizeof(Data_2_of_Node_1),         // DataLength
    Data_2_of_Node_1,                 // VarAddr
    Event_Time,                       // Event time
    Inhibit_Time,                     // Inhibit time
    CANOPEN_ASYNCPDORTRONLY);         // Paramset

CanOpenAddPDORx(
    CANNo,                             // Number of the bus line
    CANOPEN_PDO3_RX(NodeID_Node_2),    // CANID
    0,                                 // BytePos
    CANOPEN_BYTE,                      // DataType
    sizeof(Data_1_of_Node_2),          // DataLength
```

```
    Data_1_of_Node_2,                   // VarAddr
    Event_Time,                       // Event time
    Inhibit_Time,                     // Inhibit time
    CANOPEN_ASYNCPDO | CANOPEN_NORTR);  // Paramset

// All devices on the CAN bus have the status of PREOPERATIONAL

// Setting all devices on the CAN bus to OPERATIONAL status
CanOpenSetCommand(CANNo, CAN_CMD_NMT_Value(CAN_CMD_NMT_ALLNODES,
CAN_CMD_NMT), CAN_NMT_START);

// As of now, PDO telegrams are received/sent from the higher-level
// controller
//      ...
//      ...
//      ...

End_Task;
```

STX Function CanOpenAddPDOTx

Introduction

By calling up the `CanOpenAddPDOTx()` function, process data can be deposited on the bus.

However, that should not mean that other CANopen® devices on the bus can also read this process data.

Notes

- Only if the CANopen® devices on the bus are in state "operational", the PDO telegram is transmitted.
- As soon as there are any changes to the process data, another PDO telegram is transmitted immediately.
- The smallest time unit for the Event Time is 1 ms.
- The smallest time unit for the Inhibit Time is 1 ms.
- Any unused bytes of a telegram are sent as null.

Function declaration

```
Function CanOpenAddPDOTx(
    CANNo:Int,           // Number of the bus line
    CANID:Int,           // CAN identifier
    BytePos:Int,         // Starting position of the data to be sent
    DataType:Int,        // Data type of the data to be sent
    // Volume of data for the global variable VarAddr
    DataLength:Int,
    // Global variable holding the value to be sent
    const ref VarAddr,
    // Cycle time for sending telegrams (Event Time)
    EventTime: Int,
    // Minimum time lag between two telegrams to be sent
    // (Inhibit Time)
    InhibitTime: Int,
    Paramset: Int,       // Bit-coded parameter
) :Int;
```

Function parameters

The `CanOpenAddPDOTx()` function has got the following parameters:

Parameter	Description	Value
CANNo	CAN bus number	0 ... CANMAX
CANID	CAN identifier 11-bit CAN identifier 29-bit	0 ... 0x7FF 0 ... 0x1FFFFFFF
BytePos	Starting position of data to be sent	0 ... 7
DataType	Data type of data to be sent	2 ... 13, 15 ... 27
DataLength	Volume of data for the global variable VarAddr	
VarAddr	Global variable into which the value to be sent is entered	

Parameter	Description	Value
EventTime	Time lag between two telegrams (> Inhibit Time)	
InhibitTime	Minimum time lag between two telegrams to be sent (< EventTime)	
Paramset	Bit-coded parameter	

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters
-3	DataType is greater than DataLength
-4	Insufficient memory

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	0
JCM-350	4
JCM-620	2
JVM-104	0
JVM-407	2
JVM-407B	2

Parameter CANID

The CANID parameter is used to transfer the CAN identifier. The CAN identifier is generated with a macro. The CAN identifier depends on the node ID of the other communicating user and on whether it is a PDO1, PDO2, PDO3 or PDO4 message.

Macro definitions:

```
#Define CANOPEN_PDO1_RX (NodeID)     ((NodeID) + 0x180)
#Define CANOPEN_PDO2_RX (NodeID)     ((NodeID) + 0x280)
#Define CANOPEN_PDO3_RX (NodeID)     ((NodeID) + 0x380)
#Define CANOPEN_PDO4_RX (NodeID)     ((NodeID) + 0x480)

#Define CANOPEN_PDO1_TX (NodeID)     ((NodeID) + 0x200)
#Define CANOPEN_PDO2_TX (NodeID)     ((NodeID) + 0x300)
#Define CANOPEN_PDO3_TX (NodeID)     ((NodeID) + 0x400)
#Define CANOPEN_PDO4_TX (NodeID)     ((NodeID) + 0x500)
```

Example for calling up the macro:
CANOPEN_PDO2_RX (64)
⇨ The resulting CAN identifier is: 2C0h = 40h + 280h

Default CAN Identifier Distribution

For CANopen® the following CAN identifier distribution is predefined. In this case, the node number is embedded in the identifier.

11-bit identifier (binary)	Identifier (decimal)	Identifier (hexadecimal	Description
000000000000	0	0	Network Management
000100000000	128	80h	Synchronization
0001xxxxxxxx	129 - 255	81h - FFh	Emergency
0011xxxxxxxx	385 - 511	181h - 1FFh	PDO1 (tx)
0100xxxxxxxx	513 - 639	201h - 27Fh	PDO1 (rx)
0101xxxxxxxx	641 - 767	281h - 2FFh	PDO2 (tx)
0110xxxxxxxx	769 - 895	301h - 37Fh	PDO2 (rx)
0111xxxxxxxx	897 - 1023	381h - 3FFh	PDO3 (tx)
1000xxxxxxxx	1025 - 1151	401h -47Fh	PDO3 (rx)
1001xxxxxxxx	1153 - 1279	481h - 4FFh	PDO4 (tx)
1010xxxxxxxx	1281 - 1407	501h - 57Fh	PDO4 (rx)
1011xxxxxxxx	1409 - 1535	581h - 5FFh	Send SDO
1100xxxxxxxx	1537 - 1663	601h - 67Fh	Receive SDO
1110xxxxxxxx	1793 - 1919	701h - 77Fh	NMT Error Control
xxxxxxxx = Node number 1 - 127			

Parameter DataType

The following data types can be received.

Byte types	CANopen® format	Jetter format
1	CANOPEN_INTEGER8 CANOPEN_UNSIGNED8	Byte
2	CANOPEN_INTEGER16 CANOPEN_UNSIGNED16	Word
3	CANOPEN_INTEGER24 CANOPEN_UNSIGNED24	-
4	CANOPEN_INTEGER32 CANOPEN_UNSIGNED32 CANOPEN_REAL	Int
5	CANOPEN_INTEGER40 CANOPEN_UNSIGNED40	-

Byte types	CANopen® format	Jetter format
1	CANOPEN_INTEGER8 CANOPEN_UNSIGNED8	Byte
6	CANOPEN_INTEGER48 CANOPEN_UNSIGNED48 CANOPEN_TIME_OF_DAY CANOPEN_TIME_DIFFERENCE	-
7	CANOPEN_INTEGER56 CANOPEN_UNSIGNED46	-
8	CANOPEN_INTEGER64 CANOPEN_UNSIGNED64 CANOPEN_REAL64	-
n	CANOPEN_VISIBLE_STRING CANOPEN_OCTET_STRING CANOPEN_UNICODE_STRING CANOPEN_DOMAIN	String

Parameter Paramset

The following parameters can be transferred to the function. Several parameters can be linked together using the Or function.

CANOPEN_ASYNCPDORTRONLY
Send asynchronous PDOs by receiving an RTR frame.
This feature is not yet supported at the moment.

CANOPEN_ASYNCPDO
Send asynchronous PDO.

CANOPEN_PDOINVALID
PDO not sent. The required disk space is reserved.

CANOPEN_NORTR
PDO cannot be requested by RTR (Remote Request).

CANOPEN_29BIT
Use 29-bit identifier
Default: 11-bit identifier

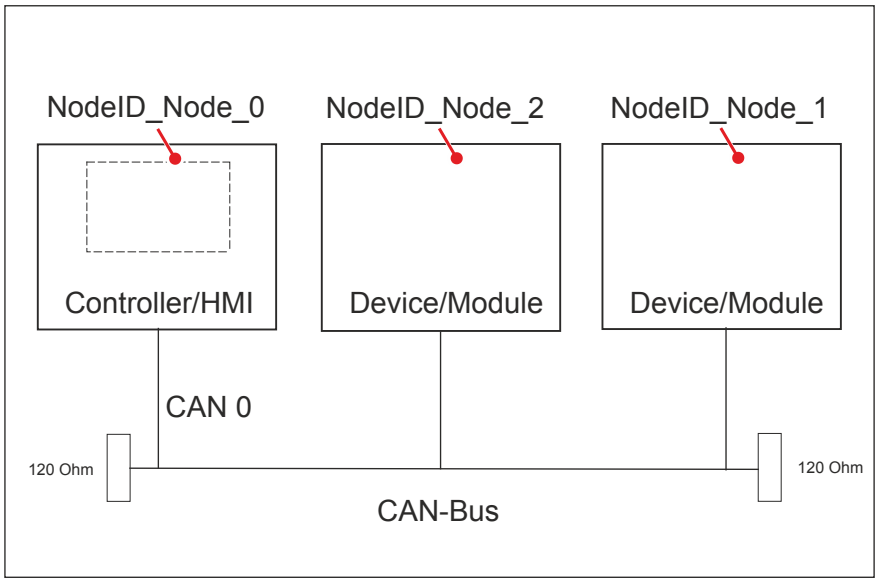
How to use this function

```
Result := CanOpenAddPDOTx(
    0,                                  // CANNo
    842,                                // CANID
    0,                                  // BytePos
    CANOPEN_DWORD,                      // DataType
    sizeof(var_Data_1_of_Node_3),       // DataLength
    var_Data_1_of_Node_3,               // VarAddr
    1000,                               // Event time
```

```
    100,                                    // Inhibit time
    CANOPEN_ASYNCPDO | CANOPEN_NORTR);      // Paramset
```

JetSym STX program

JCM-350-E01/E02 sends process data to two CANopen® devices with the node ID 74 and 112. After running the program and in the case of changes, the JCM-350-E01/E02 sends cyclic PDO telegrams every 3,000 ms (Event Time). As a maximum, the PDO telegram is sent every 10 ms (Inhibit Time).




```
Const
    CANNo = 0;              // Number of the bus line
    NodeID_Node_0 = 10;     // Device ID of node 1
    NodeID_Node_1 = 74;     // Device ID of node 2
    NodeID_Node_2 = 112;    // Device ID of node 3
    Event_Time = 3000;      // Event time in ms
    Inhibit_Time = 100;     // Inhibit time in ms
End_Const;


Var
    Data_1_of_Node_1: Int;
    Data_2_of_Node_1: Int;
    Data_1_of_Node_2: Byte;
End_Var;


Task main autorun

Var
    SW_Version: String;
End_Var;

SW_Version := 'v4.3.0.2004';

// Initializing CAN 0
CanOpenInit(CANNo,              // Number of the bus line
```

```
                NodeID_Node_0,     // Node ID
                SW_Version);       // Manufacturer's software version

// Send data per PDO
CanOpenAddPDOTx(
    CANNo,                              // Number of the bus line
    CANOPEN_PDO2_TX(NodeID_Node_1),     // CANID
    0,                                  // BytePos
    CANOPEN_DWORD,                      // DataType
    sizeof(Data_1_of_Node_1),           // DataLength
    Data_1_of_Node_1,                   // VarAddr
    Event_Time,                         // Event time
    Inhibit_Time,                       // Inhibit time
    CANOPEN_ASYNCPDORTRONLY);           // Paramset

CanOpenAddPDOTx(
    CANNo,                              // Number of the bus line
    CANOPEN_PDO2_TX(NodeID_Node_1),     // CANID
    4,                                  // BytePos
    CANOPEN_DWORD,                      // DataType
    sizeof(Data_2_of_Node_1),           // DataLength
    Data_2_of_Node_1,                   // VarAddr
    Event_Time,                         // Event time
    Inhibit_Time,                       // Inhibit time
    CANOPEN_ASYNCPDORTRONLY);           // Paramset

CanOpenAddPDOTx(
    CANNo,                                 // Number of the bus line
    CANOPEN_PDO3_TX(NodeID_Node_2),        // CANID
    0,                                     // BytePos
    CANOPEN_BYTE,                          // DataType
    sizeof(Data_1_of_Node_2),              // DataLength
    Data_1_of_Node_2,                      // VarAddr
    Event_Time,                            // Event time
    Inhibit_Time,                          // Inhibit time
    CANOPEN_ASYNCPDO | CANOPEN_NORTR);     // Paramset

// All devices on the CAN bus have the status of PREOPERATIONAL

// Setting all devices on the CAN bus to OPERATIONAL status
CanOpenSetCommand(CANNo, CAN_CMD_NMT_Value(CAN_CMD_NMT_ALLNODES,
CAN_CMD_NMT), CAN_NMT_START);

// As of now, PDO telegrams are transmitted from the devices with
// node ID 74 and 112.
//      ...
//      ...
//      ...

End_Task;
```

Heartbeat monitoring

Introduction

The heartbeat protocol is for monitoring the activity of communication partners. If the inactivity exceeds the set interval (Heartbeat consumer time), the status is set to "offline".

The application program lets you define heartbeat functions, such as

- Displaying information to the user
- Rebooting the device
- Ignoring process data

Prerequisites

Heartbeat monitoring is available only for specific devices and its availability depends on the OS version.

Device	OS version
FMC-01	1.18.1.00 or higher
JVM-C02	4.00.0.00 or higher
JCM-350	1.09.0.215 or higher
JCM-620	JVER bersion 3.2.2.645 and JetVM version 3.04.0.00 or higher

Registers for heartbeat monitoring

Heartbeat monitoring uses the following registers:

Register	Description	Data type	Attributes
40x001	Own heartbeat status of the device; value range: 0 = Bootup 4 = Stopped 5 = Operational 127 = Preoperational 255 = Offline (default value)	Int	ro (read only)
40x100	The heartbeat status of all monitored node IDs has changed. Value range: 0 = False 1 = True	Bool	rw (read and write)
40x101 ... 40x227	Heartbeat status of nodes with ID 1 ... 127; value range: 0 = Bootup 4 = Stopped 5 = Operational 127 = Preoperational 255 = Offline (default value)	Byte	ro
40x229 ... 40x355	Heartbeat timeout of nodes with ID 1 ... 127; value range: 0 ... 65535 [ms]	Word	rw

In the register number, the letter "x" represents the number of the CAN bus line used: x = 0 ... CANMAX.

Launching heartbeat monitoring

To launch heartbeat monitoring, proceed as follows:

Step	Action
1	Enable heartbeat monitoring: Enter the timeout value into the corresponding register. This value must range between 1 and 65535 [ms]. Example: For CAN 0 and node ID 1: Enter a timeout value of 3000 [ms] into register 400229.
2	Define in your application program how the device is to respond to individual values in the heartbeat status register. When the state in register 40x101 ... 40x227 changes, the value in register 40x100 changes to 1 (true).
3	Reset the value in register 40x100 to zero (false). This step ensures that subsequent changes in register 40x101 ... 40x227 can be displayed.

Hearbeat monitoring starts on receipt of the first heartbeat (including bootup message). The DLC (Data Length Code) of the heartbeat message must be 1.

Terminating heartbeat monitoring

To terminate heartbeat monitoring, proceed as follows:

Step	Action
1	Disable heartbeat monitoring: Enter a timeout value of 0 [ms] into the timeout register.

Emergency message

When a heartbeat timeout is detected, an emergency message is sent automatically.

On receipt of the next heartbeat message, the emergency message is reset.

Example:

The following emergency message is tripped:

Reference	Value
Error code	0x8130
Error Register	0x81
Manufacturer error	0x00,NodeID,0x00,0x00,0x00

The message on the CAN bus looks as shown below:

- Own NodeID 5
- Monitored NodeID 1
- ID: 0x85 DLC = 8 Data: 0x30 0x81 0x81 0x00 0x01 0x00 0x00 0x00

Emergency message Rx

The declaration of the emergency message Rx consists of the following elements:

```
CanOpenAddEmergencyRx(
    // Number of the bus line
    CANNo:int,
    // Node ID
    NodeID:int,
    // Status, number of valid messages
    ref stCanOpenEmergencyStat:CanOpenEmergencyStat,
    // Emergency message array
    ref CanOpenEmergencyMSG:CanOpenEmergencyArray,
    ):int
```

Example:

The above program lines must be included into the corresponding tasks of your application program.The example below shows an emergency message from a device with node ID 21.

```
...
// Initializing the CAN bus once.

...

// Defining global variables
VAR
    stCanOpenEmergencyMsg : ARRAY[5] of CanOpenEmergencyMsg;
    stCanOpenEmergencyStat : CanOpenEmergencyStat;
End_VAR;

stCanOpenEmergencyStat.lBuffer := sizeof(stCanOpenEmergencyMsg);
iRet:= CanOpenAddEmergencyRx(0,                        // CANNo.
                             21,                       // NodeID
                             stCanOpenEmergencyStat,   // Status
                             stCanOpenEmergencyMsg);   // Array

...
```

The above program lines produce the following result:

When the device with node ID 21 receives an emergency message, the value in register 400100 switches from 0 to 1 (true).

Reset this value always to 0 (false). In doing so, you make sure that new emergency messages are displayed.

Emergency message Tx

The declaration of the emergency message Tx consists of the following elements:

```
CanOpenAddEmergencyTx(
    // Number of the bus line
    CANNo:int,
    // Error code see CiA DS 301 V4.02, page 60
    // or CiA DS 4xx (device profile)
    ErrorCode:word,
    // Error register (object 0x1001)
    ErrorRegister:byte,
    // 5 byte freely available
    ManufacturerArray:ByteArray5,
    // True = Error has ocurred
    // False = Error does no longer exist (acknowledged)
    bSet:bool
    ):Int;
```

CANopen® object dictionary for JCM-350-E01/E02

Supported Objects

The operating system of JCM-350-E01/E02 supports the following objects:

Index (hex)	Object (Code)	Object name	Type	Attributes
1000	VAR	Device Type	Unsigned32	ro (read only)
1001	VAR	Error Register	Unsigned8	ro
1002	VAR	Manufacturer Status	Unsigned32	ro
1003	ARRAY	Pre-defined Error Field	Unsigned32	ro
1008	VAR	Manufacturer Device Name	String	const
1009	VAR	Manufacturer Hardware Version	String	const
100A	VAR	Manufacturer Software Version	String	const
100B	VAR	Node ID	Unsigned32	ro
1017	VAR	Producer Heartbeat Time	Unsigned16	rw (read & write)
1018	RECORD	Identity	Identity	ro
1200	RECORD	Server 1 - SDO parameter	SDO parameter	ro
1201	RECORD	Server 2 - SDO parameter	SDO parameter	rw
1203	RECORD	Server 3 - SDO parameter	SDO parameter	rw
1203	RECORD	Server 4 - SDO parameter	SDO parameter	rw

Device Type Object (Index 0x1000)

The structure of the "Device Type Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x1000	0	0x0000012D	Device Type (Read-Only)

Error Register Object (Index 0x1001)

The function **CanOpenAddEmergencyTx()** lets you set the bits in this register.

The structure of the "Error Register Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x1001	0	0	Error Register (Read-Only)

This object implements the CANopen® Error Register functionality.

The following error messages may be appear:

- Bit 0 = Generic error
- Bit 1 = Current error
- Bit 2 = Voltage error
- Bit 3 = Temperature error
- Bit 4 = Communication error (overrun, error state)
- Bit 5 = Specific device profile error
- Bit 6 = Reserved (always 0)
- Bit 7 = Manufacturer-specific error

Pre-defined Error Field Object (Index 0x1003)

The structure of the "Pre-defined Error Field Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x1003	0	0	Number of errors entered in the Array's Standard Error Field
	1	0	Most recent error 0 indicates no error
	2 ... 254	-	Earlier errors

This object shows a history list of errors that have been detected by the JCM-350-E01/E02. The maximum length of the list is 254 errors. The list content is deleted on restart.

Composition of standard error field

2-byte LSB: Error Code

2-byte MSB: Additional information

Manufacturer Device Name Object (Index 0x1008)

The structure of the "Manufacturer Device Name Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x1008	0	JCM-350-E01/E02	Hardware name

Manufacturer Hardware Version Object (Index 0x1009)

The structure of the "Manufacturer Hardware Version Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x1009	0		OS version of the device

Manufacturer Software Version Object (Index 0x100A)

The structure of the "Manufacturer Software Version Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x100A	0		Software version of the application program that runs on the JCM-350-E01/E02

The entry in this index is made via the parameter "SWVersion" of the STX function **CanOpenInit()**.

Node ID Object (Index 0x100B)

The structure of the "Node ID Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x100B	0		Own node ID

Producer Heartbeat Time Object (Index 0x1017)

The structure of the "Producer Heartbeat Time Object" is shown in the following table.

Index	Sub-Index	Default	Description
0x1017	0	1,000 [ms]	Heartbeat time

CANopen® registers - JCM-350-E01/E02

The table below lists the JCM-350-E01/E02 registers associated with the CANopen® Object Dictionary.

The letter x in the register number represents the CAN bus number ranging from 0 ... CANMAX.

Register number	Description	Value range	Attributes	Data type
40x000	Own node ID	1 ... 127	rw (read & write)	Int
40x001	Own heartbeat status	0 = Bootup 4 = Stopped 5 = Operational 127 = Preoperational 255 = Offline	ro (read only)	Int
40x002		Refer to object 0x1001	ro	Int
40x019			ro	Int (IP format)

Register number	Description	Value range	Attributes	Data type
40x020			rw	Int
40x021			rw	Int
40x022			rw	Int
40x023			rw	Int
40x030			rw	Int
40x100			rw	bool
40x400			rw	bool
40x101 ... 40x227	Node ID 1 ... 127 Status	0 = Bootup 4 = Stopped 5 = Operational 127 = Preoperational 255 = Offline (default)	ro	byte
40x229 ... 40x355	Node ID 1 ... 127 Timeout	0 ... 65535 ms	rw	word

7 SAE J1939 STX API

Introduction

This chapter describes the STX functions of the SAE J1939 STX API.

The SAE J1939 Standard

SAE J1939 is an open standard for networking and communication in the commercial vehicle sector. The focal point of the application is the networking of the power train and chassis. The J1939 protocol originates from the international Society of Automotive Engineers (SAE) and works on the physical layer with CAN high-speed according to ISO 11898.

Application

These STX functions are used in communication between the controller JCM-350-E01/E02 and other ECUs in the vehicle. As a rule, engine data, such as RPM, speed or coolant temperature are read and displayed.

Documentation

The key SAE J1939 specifications are:

- J1939-11 - Information on the physical layer
- J1939-21 - Information on the data link layer
- J1939-71 - Information on the application layer vehicles
- J1939-73 - Information on the application layer range analysis
- J1939-81 - Network management

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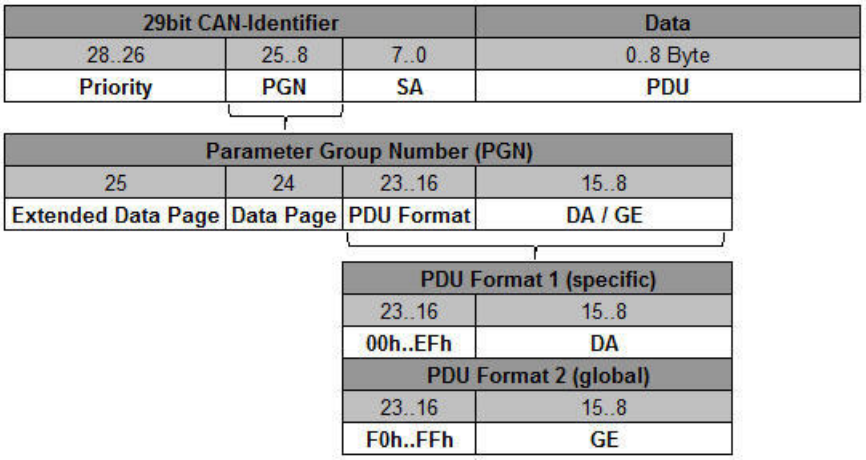
Content of a J1939 Message

Content of a J1939 Message

The following diagram shows the content of a J1939 message:



Abbreviation	Description
DA	Destination Address
GE	Group Extensions
PDU	Protocol Data Unit
PGN	Parameter Group Number
SA	Source Address

Meaning of the Parameter Group Number (PGN)

The PGN is a number defined in the SAE J1939 standard that groups together several SPNs into a meaningful group. The PGN is part of the CAN identifier. The 8-byte data (PDU) contain the values of individual SPNs.

The example below shows a PGN 65262 (0xFEEE):

PGN 65262 - ET1 **Engine Temperature 1**

Part of the PGN	Value	Remarks
Transmission Repetition Rate	1 s	
Data Length	8	
Extended Data Page	0	
Data Page	0	
PDU Format	254	
PDU Specific	238	PGN Supporting Information
Default Priority	6	
Parameter Group Number	65262	in hex: 0xFEEE

Start position	Length	Parameter name	SPN
1	1 byte	Engine Coolant Temperature	110
2	1 byte	Engine Fuel Temperature 1	174
3 - 4	2 bytes	Engine Oil Temperature 1	175
5 - 6	2 bytes	Engine Turbocharger Oil Temperature	176
7	1 byte	Engine Intercooler Temperature	52
8	1 byte	Engine Intercooler Thermostat Opening	1134

STX Function SAEJ1939Init

Introduction

Calling up the SAEJ1939Init () function initializes one of the CAN busses (not CAN 0 as this is reserved for CANopen®) for use with the J1939 protocol. From then on, the JCM-350-E01/E02 has got the SA (Source Address) assigned by the function parameter mySA. Thus, it has got its own device address on the bus.

Function declaration

```
Function SAEJ1939Init (
    CANNo:Int,
    mySA:Byte,
) :Int;
```

Function parameters

The function SAEJ1939Init () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
mySA	Own source address	0 ... 253

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters
-3	Insufficient memory for SAE J1939

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

How to use this function

Initializing the CAN-Bus 1. The JCM-350-E01/E02 has got Node SA 20 (0x14). The JCM-350-E01/E02 can now send messages with the set SA (and only these messages).

```
Result := SAEJ1939Init(1, 20);
```

Address Claiming	Address Claiming has not been implemented.

STX Function SAEJ1939SetSA

Introduction

The function SAEJ1939SetSA lets you change the own SA (Source Address) during runtime.

Function declaration

```
Function SAEJ1939SetSA (
    CANNo:Int,
    mySA:Byte,
) :Int;
```

Function parameters

The function SAEJ1939SetSA () includes the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
mySA	New SA	0 ... 253

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

How to use this function

Changing the SA during runtime.

Result := SAEJ1939SetSA(1, 20);

Important note

Messages are immediately sent/received using the new SA.

STX Function SAEJ1939GetSA

Introduction

By calling up the function SAEJ1939GetSA, you can determine the own SA (Source Address).

Function declaration

```
Function SAEJ1939GetSA (
    CANNo:Int,
    ref mySA:Byte,
) :Int;
```

Function parameters

The function SAEJ1939GetSA () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
mySA	SA currently set	0 ... 253

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

How to use this function

This function returns the currently set SA.

```
Result := SAEJ1939SetSA(1, actual_SA);
```

STX Function SAEJ1939AddRx

Introduction

Calling up the function SAEJ1939AddRx () prompts the JCM-350-E01/E02 to receive a specific message. This message is sent from another bus node. The address of this bus node is transferred to this function as a bySA parameter. If the message is not sent, the value received last remains valid. Cyclical reading continues until the function SAEJ1939Init () is called up again.

Function declaration

```
Function SAEJ1939AddRx (
    CANNo:Int,
    IPGN:Long,
    bySA:Byte,
    BytePos:Int,
    BitPos:Int,
    DataType:Int,
    DataLength:Int,
    const ref VarAddr,
    ref stJ1939:TJ1939Rx
    EventTime: Int,
    InhibitTime: Int,
) :Int;
```

Function parameters

The function SAEJ1939AddRx () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
IPGN	PGN Parameter Group Number	0 ... 0x3FFFF
bySA	Source Address of message sender	0 ... 253
BytePos	Starting position of bytes of data to be received	1 ... n
BitPos	Starting position of bits of data to be received	1 ... 8
DataType	Data type of data to be received	1 ... 3, 10 ... 16
DataLength	Volume of data for the global variable VarAddr	
VarAddr	Global variable into which the received value is entered	
TJ1939Rx	Control structure	
EventTime	Time lag between two telegrams (> Inhibit Time)	Default value: 1,000 ms
InhibitTime	Minimum time lag between two telegrams received (< EventTime)	Default value: 100 ms

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

Parameter DataType

Data types include the following types:

Byte types	Bit types	SAEJ1939
1	-	SAEJ1939_UNSIGNED8 SAEJ1939_BYTE
2	-	SAEJ1939_UNSIGNED16 SAEJ1939_WORD
4	-	SAEJ1939_UNSIGNED32 SAEJ1939_DWORD
n	-	SAEJ1939_STRING
-	1	SAEJ1939_1BIT
-	2	SAEJ1939_2BIT
-	3	SAEJ1939_3BIT
-	4	SAEJ1939_4BIT
-	5	SAEJ1939_5BIT
-	6	SAEJ1939_6BIT
-	7	SAEJ1939_7BIT

Control Structure TJ1939Rx

```
TJ1939Rx: Struct
// Status of received message
            byStatus      : Byte;
// Priority of received message
            byPriority    : Byte;
          End_Struct;
```

How to use this function

```
Result := SAEJ1939AddRx (
    1,
    0xFEEE,
    0x00,
    2
    0
    SAEJ1939_BYTE,
    sizeof(var_Fueltemp),
    var_Fueltemp,
    struct_TJ1939Rx_EngineTemperatureTbl,
    1500,
    120);
```

JetSym STX program

The device JCM-350-E01/E02 with the own SA of 20 wants to receive and display the current fuel temperature. The parameters InhibitTime and EventTime are not explicitly specified when calling up the function. In this case, the default values are used. The controller acquiring the fuel temperature has got SA 0. In practice, the address of the controller can be found in the engine manufacturer's documentation.

The fuel temperature has the SPN 174 and is a component (byte 2) of the PGN 65262 Engine Temperature 1.

```
#Include "SAEJ1939.stxp"

Var
    bySAEJ1939Channel  : Byte;
    own_Source_Address : Byte;

// PGN 65262 Engine Temperature 1
    Fueltemp  : Byte;
    EngineTemperatureTbl : TJ1939Rx;
End_Var;

Task main autorun

// Initializing CAN 1
bySAEJ1939Channel := 1;
own_Source_Address := 20;
SAEJ1939Init (bySAEJ1939Channel, own_Source_Address);

// Receiving fuel temperature
SAEJ1939AddRx (bySAEJ1939Channel, 65262, 0x00, 2, 1, SAEJ1939_BYTE,
sizeof(Fueltemp), Fueltemp, EngineTemperatureTbl);

End_Task;
```

Engine manufacturer's manual

For information on the data (priority, PGN, SA and data byte structure) refer to the manual provided by the engine manufacturer.

STX Function SAEJ1939AddTx

Introduction

Calling up the function SAEJ1939AddTx () prompts the device JCM-350-E01/E02 to cyclically send a specific message via the bus.

Cyclical sending continues until the function SAEJ1939Init () is called up again.

Date are sent once the Event Time has elapsed or the given variables have changed and Inhibit Time has elapsed.

Function declaration

```
Function SAEJ1939AddTx (
    CANNo:Int,
    IPGN:Long,
    BytePos:Int,
    BitPos:Int,
    dataType:Int,
    DataLength:Int,
    const ref VarAddr,
    ref stJ1939:TJ1939Tx
    EventTime: Int,
    InhibitTime: Int,
) :Int;
```

Function parameters

The function SAEJ1939AddTx () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
IPGN	PGN Parameter Group Number	0 ... 0x3FFFF
BytePos	Starting position of the byte of data to be sent	1 ... n
BitPos	Starting position of the bit of data to be sent	1 ... 8
dataType	Data type of data to be sent	1 ... 3, 10 ... 16
DataLength	Volume of data for the global variable VarAddr	
VarAddr	Global variable into which the value to be sent is entered	
TJ1939Tx	Control structure	
EventTime	Time lag between two telegrams (> Inhibit Time)	Default value: 1,000 ms
InhibitTime	Minimum time lag between two telegrams received (< EventTime)	Default value: 100 ms

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

Parameter DataType

Data types include the following types:

Byte types	Bit types	SAEJ1939
1	-	SAEJ1939_UNSIGNED8 SAEJ1939_BYTE
2	-	SAEJ1939_UNSIGNED16 SAEJ1939_WORD
4	-	SAEJ1939_UNSIGNED32 SAEJ1939_DWORD
n	-	SAEJ1939_STRING
-	1	SAEJ1939_1BIT
-	2	SAEJ1939_2BIT
-	3	SAEJ1939_3BIT
-	4	SAEJ1939_4BIT
-	5	SAEJ1939_5BIT
-	6	SAEJ1939_6BIT
-	7	SAEJ1939_7BIT

Control Structure TJ1939Tx

```
TJ1939Tx : Struct
// Status of sent message
            byStatus      : Byte;
// Priority of sent message
            byPriority    : Byte;
```

```
        End_Struct;
```

How to use this function

```
Result := SAEJ1939AddTx (
    1,
    0xFEEE,
    0x00,
    2
    0
    SAEJ1939_BYTE,
    sizeof(var_Fueltemp),
    var_Fueltemp,
    struct_TJ1939Tx_EngineTemperatureTbl,
    1500,
    120);
```

JetSym STX program

Redefining the priority.

Priority value 0 has the highest priority, priority value 7 has the lowest priority. A message with priority 6 can be superseded by a message with priority 4 (if the messages are sent at the same time). The parameters InhibitTime and EventTime are not explicitly specified when calling up the function. In this case, the default values are used.

```
#Include "SAEJ1939.stxp"

Var
    bySAEJ1939Channel  : Byte;
    own_Source_Address : Byte;

// PGN 65262 Engine Temperature 1
    Fueltemp  : Byte;
    EngineTemperatureTbl : TJ1939Tx;
End_Var;

Task main autorun

// Initializing CAN 1
bySAEJ1939Channel := 1;
own_Source_Address := 20;
SAEJ1939Init (bySAEJ1939Channel, own_Source_Address);

// PGN 65262 Engine Temperature
// Setting a new priority
EngineTemperatureTbl.byPriority := 6;
SAEJ1939AddTx (bySAEJ1939Channel, 65262, 0x00, 2, 1, SAEJ1939_BYTE,
sizeof(Fueltemp), Fueltemp, EngineTemperatureTbl);

End_Task;
```

Engine manufacturer's manual

For information on the data (priority, PGN, SA and data byte structure) refer to the manual provided by the engine manufacturer.

STX Function SAEJ1939RequestPGN

Introduction

Calling up the function SAEJ1939RequestPGN () sends a request to the DA (Destination Address) following a PGN.

This function is terminated only if a valid value has been received or the timeout of 1,250 ms has elapsed.

To obtain the value of the requested message its receipt must be scheduled using the function SAEJ1939AddRx ().

This function must constantly be recalled in cycles.

Function declaration

```
Function SAEJ1939RequestPGN (
    CANNo:Int,
    byDA:Byte,
    ulPGN:Long,
    byPriority:Byte,
) :Int;
```

Function parameters

The function SAEJ1939RequestPGN () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
byDA	Destination Address Address from which the message is requested	0 ... 253 The own SA cannot be used
ulPGN	PGN Parameter Group Number	0 ... 0x3FFFF
byPriority	Priority	0 ... 7 Default value: 6

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	Message has been received
-1	Timeout, as no reply has been received

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a

Device	CANMAX
JVM-407	2
JVM-407B	2

Parameter DataType

Data types include the following types:

Byte types	Bit types	SAEJ1939
1	-	SAEJ1939_UNSIGNED8 SAEJ1939_BYTE
2	-	SAEJ1939_UNSIGNED16 SAEJ1939_WORD
4	-	SAEJ1939_UNSIGNED32 SAEJ1939_DWORD
n	-	SAEJ1939_STRING
-	1	SAEJ1939_1BIT
-	2	SAEJ1939_2BIT
-	3	SAEJ1939_3BIT
-	4	SAEJ1939_4BIT
-	5	SAEJ1939_5BIT
-	6	SAEJ1939_6BIT
-	7	SAEJ1939_7BIT

How to use this function

```
Result := SAEJ1939RequestPGN (
    1,
    0x00,
    0xFEE5,
    5);
```

JetSym STX program

JCM-350-E01/E02 with own SA of 20 wants to request the PGN 65253 "Engine Hours" from an engine control unit with the SA 0. The SPN 247 "Engine Total Hours of Operation" should be read from this PGN. It is therefore necessary to register receipt of the SPN 247 by calling up the function SAEJ1939AddRx ().

The parameter "byPriority" is not explicitly specified when calling up the function. In this case, the default value is used.

```
#Include "SAEJ1939.stxp"

Var
    bySAEJ1939Channel  : Byte;
    own_Source_Address : Byte;

// PGN 65253 Engine Hours, Revolutions
    EngineTotalHours  : Int;
    EngineHoursTbl : TJ1939Rx;
```

```
End_Var;

Task main autorun

// Initializing CAN 1
bySAEJ1939Channel := 1;
own_Source_Address := 20;
SAEJ1939Init (bySAEJ1939Channel, own_Source_Address);

// Engine Hours, Revolutions  -- on Request
SAEJ1939AddRx (bySAEJ1939Channel, 65253, 0x00, 1, 0,
SAEJ1939_DWORD, sizeof(EngineTotalHours), EngineTotalHours,
EngineHoursTbl, 5000, 150);

// Required for a cyclical task
TaskAllEnableCycle ();
EnableEvents;

End_Task;


Task t_RequestPGN_5000 cycle 5000

Var
    Return_value : Int;
End_Var;

// Requesting total machine operating hours
Return_value := SAEJ1939RequestPGN (bySAEJ1939Channel, 0x00,
65253);

If Return_value Then
      Trace ('PGN Request failed');
End_If;

End_Task;
```

STX Function SAEJ1939GetDM1

Introduction

Calling up the function SAEJ1939GetDM1 () requests the current diagnostics error codes (also see SAE J1939-73 No. 5.7.1). The corresponding PGN number is 65226. This function must constantly be recalled in cycles.

Function declaration

```
Function SAEJ1939GetDM1 (
    CANNo:Int,
    bySA:Byte,
    ref stJ1939DM1stat:TJ1939DM1STAT
    ref stJ1939DM1msg:TJ1939DM1MSG
) :Int;
```

Function parameters

The function SAEJ1939GetDM1 () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
bySA	Source Address of message sender	0 ... 253 The own SA cannot be used
stJ1939DM1stat	lStatus lMsgCnt lBuffer	Lamp Status Number of received messages Size of variable stJ1939DM1msg
stJ1939DM1msg	lSPN byOC byFMI	Error Code Error counter Error Type

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a

Device	CANMAX
JVM-407	2
JVM-407B	2

stJ1939DM1stat.lStatus

Default: 0xFF00

Type	Byte	Bit group	Description
Status	1	8 - 7	Malfunction Indicator Lamp Status
		6 - 5	Red Stop Lamp Status
		4 - 3	Amber Warning Lamp Status
		2 - 1	Protect Lamp Status
Flash	2	8 - 7	Flash Malfunction Indicator Lamp
		6 - 5	Flash Red Stop Lamp
		4 - 3	Flash Amber Warning Lamp
		2 - 1	Flash Protect Lamp

Type	Byte	Bit group Value	Description
Status	1	00	Lamps off
		01	Lamps on
Flash	2	00	Slow Flash (1 Hz, 50 % duty cycle)
		01	Fast Flash (2 Hz or faster, 50 % duty cycle)
		10	Reserved
		11	Unavailable / Do Not Flash

stJ1939DM1msg

Default value:
ISPN = 0
byOC = 0
byFMI = 0
For older controllers (grandfathered setting):
ISPN = 524287 (0x7FFFF)
byOC = 31 (0x1F)
byFMI = 127 (0x7F)

How to use this function

```
Result := SAEJ1939GetDM1 (
    1,
    0x00,
    stdm1stat_pow,
    stdm1msg_pow,);
```

JetSym STX program

By calling up the function SAEJ1939GetDM1 (), the JCM-350-E01/E02 requests the current diagnostics error code (PGN 65226).

```
#Include "SAEJ1939.stxp"

Var
    bySAEJ1939Channel  : Byte;
    own_Source_Address : Byte;
    stdm1stat_pow : TJ1939DM1STAT;
    stdm1msg_pow : Array[10] of STJ1939DM1MSG;
    MyTimer : TTimer;
End_Var;

Task main autorun

// Initializing CAN 1
bySAEJ1939Channel := 1;
own_Source_Address := 20;
SAEJ1939Init (bySAEJ1939Channel, own_Source_Address);

TimerStart (MyTimer, T#2s);

Loop

When (TimerEnd (MyTimer)) Continue;


stdm1stat_pow.lBuffer := sizeof (stdm1msg_pow);
SAEJ1939GetDM1 (bySAEJ1939Channel, 0x00, stdm1stat_pow,
stdm1msg_pow);

TimerStart (MyTimer, T#2s);

End_Loop;

End_Task;
```

STX Function SAEJ1939GetDM2

Introduction

Calling up the function SAEJ1939GetDM2 () requests the diagnostics error codes that preceded the current ones (also see SAE J1939-73 No. 5.7.2). The corresponding PGN number is 65227.

Function declaration

```
Function SAEJ1939GetDM2 (
    CANNo:Int,
    bySA:Byte,
    ref stJ1939DM2stat:TJ1939DM2STAT
    ref stJ1939DM2msg:TJ1939DM2MSG
) :Int;
```

Function parameters

The function SAEJ1939GetDM2 () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
bySA	Source Address of message sender	0 ... 253 The own SA cannot be used
stJ1939DM2stat	lStatus lMsgCnt lBuffer	Lamp status Number of received messages Size of variable stJ1939DM2msg
stJ1939DM2msg	lSPN byOC byFMI	Error Code Error counter Error Type

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a

Device	CANMAX
JVM-407	2
JVM-407B	2

stJ1939DM2stat.lStatus

Default: 0xFF00

Type	Byte	Bit group	Description
Status	1	8 - 7	Malfunction Indicator Lamp Status
		6 - 5	Red Stop Lamp Status
		4 - 3	Amber Warning Lamp Status
		2 - 1	Protect Lamp Status
Flash	2	8 - 7	Flash Malfunction Indicator Lamp
		6 - 5	Flash Red Stop Lamp
		4 - 3	Flash Amber Warning Lamp
		2 - 1	Flash Protect Lamp

Type	Byte	Bit group Value	Description
Status	1	00	Lamps off
		01	Lamps on
Flash	2	00	Slow Flash (1 Hz, 50 % duty cycle)
		01	Fast Flash (2 Hz or faster, 50 % duty cycle)
		10	Reserved
		11	Unavailable / Do Not Flash

stJ1939DM2msg

Default value:
ISPN = 0
byOC = 0
byFMI = 0
For older controllers (grandfathered setting):
ISPN = 524287 (0x7FFFF)
byOC = 31 (0x1F)
byFMI = 127 (0x7F)

How to use this function

```
Result := SAEJ1939GetDM2 (
    1,
    0x00,
    stdm2stat_pow,
    stdm2msg_pow,);
```

JetSym STX program

By calling up the function SAEJ1939GetDM2 (), the JCM-350-E01/E02 requests the current diagnostics error codes (PGN 65227).

```
#Include "SAEJ1939.stxp"

Var
    bySAEJ1939Channel  : Byte;
    own_Source_Address : Byte;
    stdm2stat_pow : TJ1939DM2STAT;
    stdm2msg_pow : Array[10] of STJ1939DM2MSG;
End_Var;

// Initializing CAN 1
bySAEJ1939Channel := 1;
own_Source_Address := 20;
SAEJ1939Init (bySAEJ1939Channel, own_Source_Address);

// Required for a cyclical task
TaskAllEnableCycle ();
EnableEvents;

End_Task;


Task t_RequestPGN_5000 cycle 5000

Var
    Return_value : Int;
End_Var;

// Requesting diagnostics error codes DM2 POW
stdm2stat_pow.lBuffer := sizeof (stdm2msg_pow);
Return_value := SAEJ1939GetDM2 (bySAEJ1939Channel, 0x00,
stdm2stat_pow, stdm2msg_pow);

If Return_value Then
    Trace ('DM2 Request failed');
End_If;

End_Task;
```

STX Function SAEJ1939SetSPNConversion

Introduction

Calling up the function SAEJ1939SetSPNConversion () determines the configuration of bytes in the message, which is requested using function SAEJ1939GetDM1 () or SAEJ1939GetDM2 (). In other words, it specifies the conversion method.

Function declaration

```
Function SAEJ1939SetSPNConversion (
    CANNo:Int,
    bySA:Byte,
    iConversionMethod:Int,
) :Int;
```

Function parameters

The function SAEJ1939SetSPNConversion () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
bySA	Source Address of message sender	0 ... 253
iConversionMethod	Conversion method	1 ... 4 4: Automatic detection 2: Default

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

How to use this function

```
Result := SAEJ1939SetSPNConversion (
    1,
    0xAE,
    4);
```

STX Function SAEJ1939GetSPNConversion

Introduction

Calling up the function SAEJ1939GetSPNConversion () ascertains the current conversion method set.

Function declaration

```
Function SAEJ1939SetSPNConversion (
    CANNo:Int,
    bySA:Byte,
    iConversionMethod:Int,
) :Int;
```

Function parameters

The function SAEJ1939GetSPNConversion () has the following parameters.

Parameter	Description	Value
CANNo	CAN channel number	1 ... CANMAX
bySA	Source Address of message sender	0 ... 253
iConversionMethod	Conversion method	1 ... 4 4: Automatic detection 2: Default

Return value

This function transfers the following return values to the higher-level program.

Return value	
0	OK
-1	Error when checking parameters

Parameter CANNo

The value of the CANMAX parameter depends on the device. The following table provides information on this point.

Device	CANMAX
BTM 07	2
BTM 012	1 - 2
BTM 011	n/a
JCM-350	4
JCM-620	2
JVM-104	n/a
JVM-407	2
JVM-407B	2

How to use this function

```
Result := SAEJ1939GetSPNConversion (
    1,
    0xAE,
    actual_conversion_method);
```

8 Programming the JCM-350-E01/E02

Purpose of this chapter

This chapter supports you in programming a JCM-350-E01/E02 to be installed in a vehicle. It covers the following topics:

- Programming the JCM-350-E01/E02
- Examples of how to use individual registers of a JCM-350-E01/E02

Use of placeholders

To avoid repetitions and to simplify representation we use the following placeholders:

Placeholder	Usage	Description
x	Several similar registers or similar I/Os	Simplifies description. Digital outputs, for example, have the same properties when used with different registers and outputs.
y	If the JCM-350-E02 is equipped with two I/O modules to distinguish between: ■ I/O module 1 ■ I/O module 2	Here "y" stands for value "1" or "2". Value "1" relates to connectors X110, X118, X119. Value "2" relates to connectors X210, X218, X219. **Note:** In the case of JCM-350-**E01** "y" is always 1.

Example of how to use placeholders

The following example refers to the value of digital input 7:
Register number 600y001xx represents the register of the digital input.

If you wish to address digital input 7 on connector X218, replace the placeholder as follows:

- Replace "y" by "2"
- and "xx" by "07"

The resulting register number R 600200107 refers to the following:

- "2" stands for model JCM-350-**E02**
- "07" stands for digital input 7 at pin 30 of connector X218

If you wish to address digital input 7 on connector X118, replace the placeholder as follows:

- Replace "y" by "1"
- and "xx" by "07"

The resulting register number R 600100107 refers to the following:

- "1" stands for model JCM-350-**E01**
- "07" stands for digital input 7 at pin 30 of connector X118

Prerequisites

To be able to program the JCM-350-E01/E02, the following prerequisites must be fulfilled:

- A USB CAN adaptor between PC and JCM-350-E01/E02 and the driver software for this adaptor have been installed.

The device is now connected to a PC via CAN bus.

- The programming tool JetSym 4.3 or higher is installed on the PC.

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Abbreviations, module register properties and formats

Abbreviations

The abbreviations used in this document are listed in the following table:

Abbreviation	Description
R 100	Register 100
MR 150	Module register 150

Module register properties

Each module register is characterized by certain properties. For many module registers most properties are identical. For example, their value after reset is zero. In the following description, module register properties are mentioned only if a property deviates from the following default properties.

Module register properties	Default property for most module registers
Type of access	Read/write
Value after reset	0 or undefined (e.g. the release number)
Takes effect	Immediately
Write access	Always
Data type	Integer

Number formats

The number formats used in this document are listed in the following table:

Notation	Numerical format
100	Decimal
0x100	Hexadecimal
0b100	Binary

JetSym sample programs

The notation for sample programs used in this document is listed in the following table:

Notation	Description
`Var, When, Task`	Keyword
`BitClear();`	Commands
`100 0x100 0b100`	Constant numerical values
`// This is a comment`	Comment
`// ...`	Further program processing

8.1 Programming the device

Introduction

This chapter describes how to program cross-module registers and the state of I/O modules 1 and 2.
These registers let you enable communication and enable or disable, for example, analog or digital peripherals.

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Overview of Registers: JCM-350-E01/E02 - Status and instructions

R 600000020

Launching the STX program

The value of this register defines the operating mode of the controller.

Register properties		
Values	0	STOP
	1	RUN
	2	LOAD
Type of access	Read access: Present value	
	Write access: New value; becomes effective after restart	

R 600000400

Communication status

Register R 600000400 indicates in bit-coded format the status of communication enabling:

Register properties		
Values	00	Communication is not enabled.
	01	Communication for I/O module 1 is enabled.
	10	Communication for I/O module 2 is enabled.

R 600000401

Communication is enabled

Communication enabling applies to the following:

- Digital I/Os
- Relay
- Frequency inputs

To enable communication, enter the following values into register R 600000401: Value "11" for I/O module 1, or value "12" for I/O module 2.

Commands	
11	**Communication for I/O module 1 is enabled.**
12	**Communication for I/O module 2 is enabled.**

R 600y44000

Status register of I/O module 1/2

This register indicates the status of the I/O module in bit-coded format.

Meaning of the individual bits	
Bit 26	**Calibration values loaded**
	1 = Internal set-up: Calibration values correctly loaded
Bit 27	**Calibration values loaded**
	1 = Internal set-up: Calibration values correctly loaded
Bit 28	**Calibration values loaded**
	1 = Internal set-up: Calibration values correctly loaded
Bit 29	**Calibration values loaded**
	1 = Internal set-up: Calibration values correctly loaded
Bit 30	**Calibration values loaded**
	1 = Internal set-up: Calibration values correctly loaded
Bit 31	**Calibration values loaded**
	1 = Internal set-up: Calibration values correctly loaded

Register properties	
Type of access	Read access

R 600y44001

Command register for I/O module 1/2

Command register R 600y44001 for I/O module 1/2 lets you do the following:

- Enable or disable I/Os
- Reset error bits

Commands	
1	Enable all I/Os
2	Disable all I/Os
29	Clears all bits of register R 600y44031, such as error bits of voltage monitor, H-bridge 1/2 overload, PWM 1 ... 8 overload.

R 600y44010

Battery status

This register indicates the battery status of the corresponding I/O module.

Register properties	
Values	8,000 ... 32,000 (voltage in mV)
Typical	e. g. 24,000 representing 24 V
Type of access	Read only

R 600y44030

Voltage monitor of I/O module 1/2

This register indicates the supply voltage of the corresponding I/O module.
Purpose:

- Bit n = 0: Voltage is OK
- Bit n = 1: Supply voltage is below 8.5 V (typ.)

If all bits in register R 600y44030 are zero, all voltage supply values are OK.

Meaning of the individual bits		
Bit 1	**Voltage supply monitoring - PWM**	
	1 =	Supply voltage too low
Bit 2	**Voltage supply monitoring - H-bridge 1**	
	1 =	Supply voltage too low
Bit 3	**Voltage supply monitoring - H-bridge 2**	
	1 =	Supply voltage too low
Bit 4	**Voltage supply monitoring - Digital outputs 1 ... 4**	
	1 =	Supply voltage too low
Bit 5	**Voltage supply monitoring - Digital outputs 5 ... 8**	
	1 =	Supply voltage too low
Bit 6	**Voltage supply monitoring - Analog outputs**	
	1 =	Supply voltage too low

Register properties	
Type of access	Read access
y	"1" for I/O module 1, or "2" for I/O module 2

R 600y44031 **Voltage monitor with latch function - I/O module 1/2**

This register indicates the supply voltage of the corresponding I/O module.

Purpose:

- Bit n = 0: Voltage is OK
- Bit n = 1: Supply voltage is below 8.5 V (typ.)

If all bits in register R 600y44031 are zero, all voltage supply values are OK.

The function of this register is identical with that of register R 600y44030. The only difference is that you must clear individual bits yourself (e. g. in the application program).

Meaning of the individual bits	
Bit 1	**Voltage supply monitoring - PWM**
	1 = Supply voltage too low
Bit 2	**Voltage supply monitoring - H-bridge 1**
	1 = Supply voltage too low
Bit 3	**Voltage supply monitoring - H-bridge 2**
	1 = Supply voltage too low
Bit 4	**Voltage supply monitoring - Digital outputs 1 ... 4**
	1 = Supply voltage too low
Bit 5	**Voltage supply monitoring - Digital outputs 5 ... 8**
	1 = Supply voltage too low
Bit 6	**Voltage supply monitoring - Analog outputs**
	1 = Supply voltage too low

Register properties	
Read access	Actual value
Write access	Clearing value

R 600000010

Timeout counter - Data protocol

This register is a timeout counter for the internal data protocol. When the event "Busy Timeout" occurs, the error counter is incremented by one.

This register allows read/write access.

Register properties	
Name	Error Busy Timeout Counter
Value range	32 bits
Read access	Actual value
Write access	New value

R 600000011

FrameCheckSequence_Wrong Counter

This register is a counter for the internal data protocol. When the event "FrameCheckSequence" occurs, the error counter is incremented by one.

This register allows read/write access.

Register properties	
Name	FrameCheckSequence_Wrong Counter
Value range	32 bits
Read access	Actual value
Write access	New value

R 104531

IP address

This register lets you set the IP address.

This register allows read/write access. This register is remanent.

Register properties	
Name	IP address
Value range	32 bits
Read access	Actual value
Write access	New value

R 104532

IP mask

This register lets you set the IP mask.
This register allows read/write access. This register is remanent.

Register properties	
Name	IP mask
Value range	32 bits
Read access	Actual value
Write access	New value

R 104533

IP gateway

This register lets you set the IP gateway.
This register allows read/write access. This register is remanent.

Register properties	
Name	IP gateway
Value range	32 bits
Read access	Actual value
Write access	New value

R 600y21x02

Unscaled temperature measurement in [°C] at location 1/2/3 of I/O module 1/2

The device measures its PCB temperature at three locations. Register R 600y21x102 indicates the unscaled value ranging 0 ... 4.095 (where x = 1 ... 3).

Register properties	
Name	Temperature 1 / 2 / 3
Value range	0 ... 4,095
Read access	Allowed
Write access	Disabled

R 600y21x03

Scaled temperature measurement in [°C] at location 1/2/3 of I/O module 1/2

The device measures its PCB temperature at three locations. The temperature is displayed in [°C].

Register R 600y21x103 displays the temperature in [°C]. The conversion is based on the value contained in register R 600y21x102 (where x = 1 ... 3).

The measuring range of the sensors is 60 ... 125 °C.

Register properties	
Name	Temperature 1 / 2 / 3 converted into °C
Value range	32 bits
Read access	Present value in °C starting from 60 °C
Write access	Disabled

8.2 Programming the operator panel

Introduction

This chapter describes how to program the operator panel. The JCM-350-E01/E02 is available with two different operator panels. These two models differ in their appearance and in the way they are programmed:

- Operator panel mode 1 has dual-color LEDs
- Operator panel mode 2 has single-color LEDs

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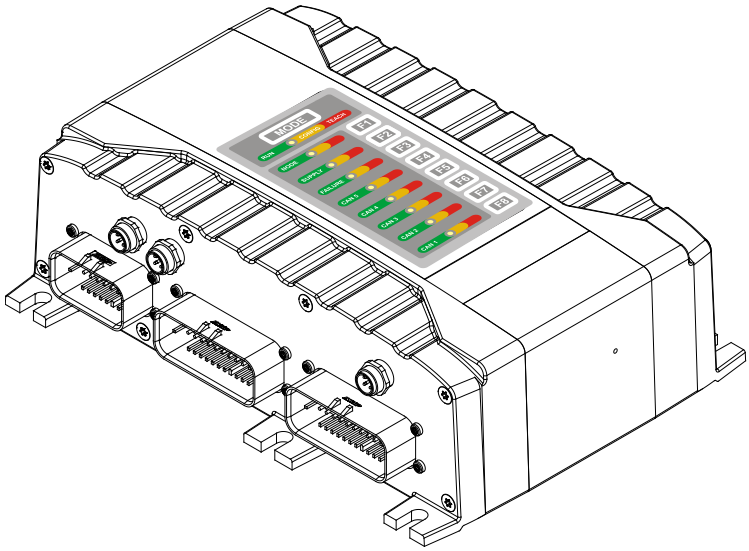
Operator panel: Programming, variant 1

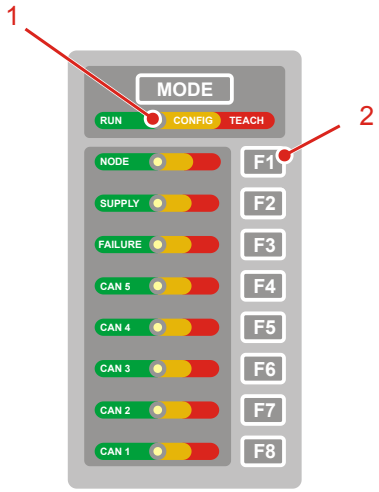
Operator panel

Jetter AG do no longer ship this model of the operator panel.
The illustration below shows a JCM-350-E01/E02:



Operator panel, variant 1

The illustration below shows how the operator panel is arranged:



Number	Description
1	Dual-color mode LED (green/red)
2	Keys F1 through F8

The operator panel uses the third color to indicate a further mode (e. g. CONFIG). If you mix the two colors by activating green and red at the same time, you get a third color, i. e. amber.

Description of Registers: Operator panel, variant 1

R 600000312

Keyboard

Register "Keyboard" indicates the key state of the operator panel in bit-coded format.

This register is write-protected, not remanent and contains the current state of the keyboard.

Meaning of the individual bits	
Bit 0	**State of key "F1"** 1 = Key F1 pressed
Bit 1	**State of key "F2"** 1 = Key F2 pressed
Bit 2	**State of key "F3"** 1 = Key F3 pressed
Bit 3	**State of key "F4"** 1 = Key F4 pressed
Bit 4	**State of key "F5"** 1 = Key F5 pressed
Bit 5	**State of key "F6"** 1 = Key F6 pressed
Bit 6	**State of key "F7"** 1 = Key F7 pressed
Bit 7	**State of key "F8"** 1 = Key F8 pressed
Bit 8	**State of key "MODE"** 1 = Key MODE pressed

Register properties	
Type of access	Read only

R 600000320

LED_green

Register "LED_green" indicates the state of the green LEDs on the operator panel.

This register allows read/write access.

Meaning of the individual bits		
Bit 0	**Status of green LED "NODE"**	
	1 =	Green LED "NODE" is lit
Bit 1	**Status of green LED "SUPPLY"**	
	1 =	Green LED "SUPPLY" is lit
Bit 2	**Status of green LED "FAILURE"**	
	1 =	Green LED "FAILURE" is lit
Bit 3	**Status of green LED "CAN 5"**	
	1 =	Green LED "CAN 5" is lit
Bit 4	**Status of green LED "CAN 4"**	
	1 =	Green LED "CAN 4" is lit
Bit 5	**Status of green LED "CAN 3"**	
	1 =	Green LED "CAN 3" is lit
Bit 6	**Status of green LED "CAN 2"**	
	1 =	Green LED "CAN 2" is lit
Bit 7	**Status of green LED "CAN 1"**	
	1 =	Green LED "CAN 1" is lit

Register properties	
Read access	Actual value
Write access	New value

R 600000321

LED_red

Register "LED_red" indicates the state of the red LEDs on the operator panel. This register allows read/write access.

Meaning of the individual bits	
Bit 0	**Status of red LED "NODE"**
	1 = Red LED "NODE" is lit
Bit 1	**Status of red LED "SUPPLY"**
	1 = Red LED "SUPPLY" is lit
Bit 2	**Status of red LED "FAILURE"**
	1 = Red LED "FAILURE" is lit
Bit 3	**Status of red LED "CAN 5"**
	1 = Red LED "CAN 5" is lit
Bit 4	**Status of red LED "CAN 4"**
	1 = Red LED "CAN 4" is lit
Bit 5	**Status of red LED "CAN 3"**
	1 = Red LED "CAN 3" is lit
Bit 6	**Status of red LED "CAN 2"**
	1 = Red LED "CAN 2" is lit
Bit 7	**Status of red LED "CAN 1"**
	1 = Red LED "CAN 1" is lit

Register properties	
Read access	Actual value
Write access	New value

R 600000322

LED_green RUN/CONFIG/TEACH

Register "LED_green RUN/CONFIG/TEACH" indicates in bit-coded form the state of the green LEDs "RUN/CONFIG/TEACH" on the operator panel.

This register allows read/write access.

Meaning of the individual bits

Bit 0 **Status of green LED "RUN/CONFIG/TEACH"**

1 = Green LED "RUN/CONFIG/TEACH" is lit

Register properties	
Read access	Actual value
Write access	New value

R 600000323

LED_red RUN/CONFIG/TEACH

Register "LED_red RUN/CONFIG/TEACH" indicates in bit-coded form the state of the red LEDs "RUN/CONFIG/TEACH" on the operator panel.

This register allows read/write access.

Meaning of the individual bits

Bit 0 **Status of red LED "RUN/CONFIG/TEACH"**

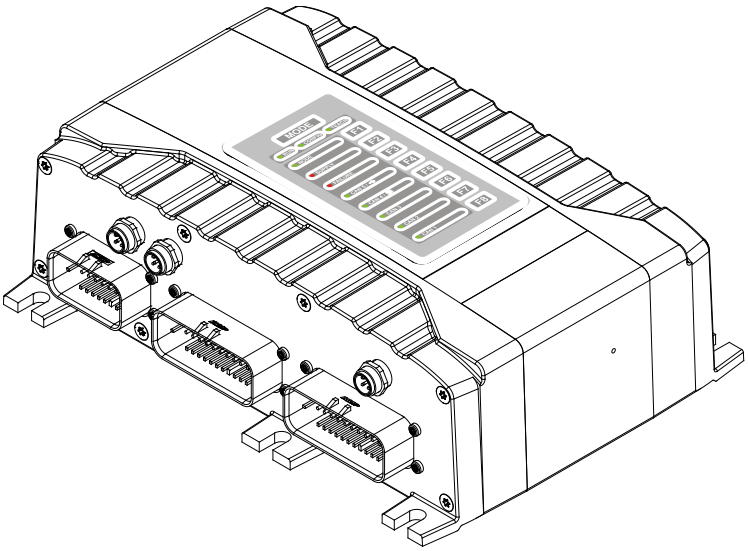
1 = Red LED "RUN/CONFIG/TEACH" is lit

Register properties	
Read access	Actual value
Write access	New value

Operator panel: Programming, variant 2

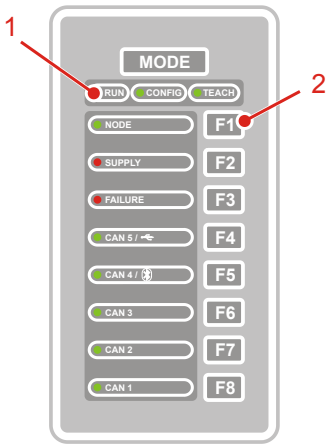
Operator panel

The illustration below shows a JCM-350-E01/E02:



Operator panel, variant 2

The illustration below shows how the operator panel is arranged:



Number	Description
1	Single-color mode LEDs (green or red)
2	Keys F1 through F8

Description of Registers: Operator panel, variant 2

R 600000312

Keyboard

Register "Keyboard" indicates the key state of the operator panel in bit-coded format.

This register is write-protected, not remanent and contains the current state of the operator panel.

Meaning of the individual bits		
Bit 0	**State of key "F1"**	
	1 =	Key F1 pressed
Bit 1	**State of key "F2"**	
	1 =	Key F2 pressed
Bit 2	**State of key "F3"**	
	1 =	Key F3 pressed
Bit 3	**State of key "F4"**	
	1 =	Key F4 pressed
Bit 4	**State of key "F5"**	
	1 =	Key F5 pressed
Bit 5	**State of key "F6"**	
	1 =	Key F6 pressed
Bit 6	**State of key "F7"**	
	1 =	Key F7 pressed
Bit 7	**State of key "F8"**	
	1 =	Key F8 pressed
Bit 8	**State of key "MODE"**	
	1 =	Key MODE pressed

Register properties	
Type of access	Read only

R 600000320

LED_green

Register 600000320 indicates the state of the LEDS on the operator panel in bit-coded format.

This register allows read/write access.

Meaning of the individual bits	
Bit 0	**Status of green LED "NODE"**
	1 = Green LED "NODE" is lit
Bit 1	**Status of red LED "FAILURE"**
	1 = Red LED "FAILURE" is lit
Bit 2	**Status of green LED "CAN 4"**
	1 = Green LED "CAN 4" is lit
Bit 3	**Status of green LED "CAN 2"**
	1 = Green LED "CAN 2" is lit
Bit 4	**Status of green LED "RUN"**
	1 = Green LED "RUN" is lit
Bit 5	**Status of green LED "TEACH"**
	1 = Green LED "TEACH" is lit

Register properties	
Read access	Actual value
Write access	New value

R 600000321

LED_red

Register 600000321 indicates the state of the LEDS on the operator panel in bit-coded format.

This register allows read/write access.

Meaning of the individual bits		
Bit 0	**Status of red LED "SUPPLY"**	
	1 =	Red LED "SUPPLY" is lit
Bit 1	**Status of green LED "CAN 5"**	
	1 =	Green LED "CAN 5" is lit
Bit 2	**Status of green LED "CAN 3"**	
	1 =	Green LED "CAN 3" is lit
Bit 3	**Status of green LED "CAN 1"**	
	1 =	Green LED "CAN 1" is lit
Bit 4	**Status of green LED "CONFIG"**	
	1 =	Green LED "CONFIG" is lit

Register properties	
Read access	Actual value
Write access	New value

8.3 Programming digital inputs and outputs

Introduction

This chapter describes how digital input and output signals are processed.

Independence of digital inputs and outputs

Each digital input and output can be configured and operated regardless of the configuration of the other digital inputs and outputs.

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8.3.1 Digital output 1 ... 8

Introduction

This chapter describes how digital outputs are used.

- Monitoring of outputs
- Bit-coded access to digital outputs 1 ... 8
- Special functions:
  - Bit-coded access to analog outputs as digital outputs
  - Bit-coded access to PWM outputs as digital outputs

Addressing by means of placeholders

The table below shows how placeholders are used to address individual digital outputs. Throughout this chapter the following rules apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 8	Digital output 1 ... 8

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Registers for monitoring digital values

R 600y00000

Status of digital outputs 1 ... 8

This register contains the value of the individual digital output.

Meaning of the individual bits		
Bit 0	**Collective message "I^2t overload"**	
	1 =	At least one output has an I^2t overload
Bit 1	**Status of digital output 1**	
	1 =	Output is short-circuited
Bit 2	**Status of digital output 2**	
	1 =	Output is short-circuited
Bit 3	**Status of digital output 3**	
	1 =	Output is short-circuited
Bit 4	**Status of digital output 4**	
	1 =	Output is short-circuited
Bit 5	**Status of digital output 5**	
	1 =	Output is short-circuited
Bit 6	**Status of digital output 6**	
	1 =	Output is short-circuited
Bit 7	**Status of digital output 7**	
	1 =	Output is short-circuited
Bit 8	**Status of digital output 8**	
	1 =	Output is short-circuited

Register properties	
Name	Status of digital outputs
Type of access	Read only

R600y01000

Status of I^2t monitoring of digital outputs 1 ... 8

This register contains the value of I^2t monitoring of digital outputs. Command 22 lets you clear the state "Overload". Bit 9 and bit 10 are I^2t collective bits for digital outputs 1 ... 4 and 5 ... 8.

Meaning of the individual bits	
Bit 1	**Status of digital output 1** 1 = Output is overloaded
Bit 2	**Status of digital output 2** 1 = Output is overloaded
Bit 3	**Status of digital output 3** 1 = Output is overloaded
Bit 4	**Status of digital output 4** 1 = Output is overloaded
Bit 5	**Status of digital output 5** 1 = Output is overloaded
Bit 6	**Status of digital output 6** 1 = Output is overloaded
Bit 7	**Status of digital output 7** 1 = Output is overloaded
Bit 8	**Status of digital output 8** 1 = Output is overloaded
Bit 9	**Status of overcurrent monitoring, collective bit for 1 ... 4** 1 = I^2t overcurrent (total current) trip for digital outputs 1 ... 4
Bit 10	**Status of overcurrent monitoring, collective bit for 5 ... 8** 1 = I^2t overcurrent (total current) trip for digital outputs 5 ... 8

Register properties	
Name	Status of I^2t monitoring for each output
Type of access	Read access

R 600y01001x

Status of I^2t monitoring of digital outputs 1 ... 8

This register indicates the status of I2t monitoring of the digital outputs.

Register properties		
Values	0	Digital output x - No overload
	1	I^2t monitoring signals overload

R 600y0010x

Value of I^2t monitoring of individual digital outputs

This register contains a value indicating the heating of each digital output.

Register properties		
Values	0% ...	Digital output x - No overload
	100%	I^2t monitoring signals overload

R 600y00109

Value of I^2t monitoring of digital outputs 1 ... 4

This register indicates the status of overcurrent protection for outputs 1 ... 4.

Register properties		
Values	0% ...	Digital outputs 1 ... 4 - No overload.
	100%	I^2t monitoring signals overload

R 600y00110

Value of I^2t monitoring of individual digital outputs

This register indicates the status of overcurrent protection for outputs 5 ... 8.

Register properties		
Values	0% ...	Digital outputs 5 ... 8 - No overload.
	100%	I^2t monitoring signals overload

R 600y22x03

Current of digital output 1 ... 8

The value in this register is output in mA,
where a value of 1,230 corresponds to an amperage of 1.23 A.

Register properties		
Value	In mA	0 ... 40,000

Registers for digital value output

Assignment of digital outputs to registers

The table below lists the registers and the assigned digital outputs 1 ... 8.

No.	Register	Pin (y = 1)	Pin (y = 2)
1	R 600y00201	X119.08	X219.08
2	R 600y00202	X119.06	X219.06
3	R 600y00203	X119.09	X219.09
4	R 600y00204	X119.07	X219.07
5	R 600y00205	X118.13	X218.13
6	R 600y00206	X118.01	X218.01
7	R 600y00207	X118.24	X218.24
8	R 600y00208	X118.14	X218.14

R 600y0020x

Value of digital output x

The value in this register is output as digital value (bit) at the connector.

Register properties		
Values	0	Output level is low
	1	Output level is high

Assignment of analog outputs to registers

Analog outputs can also be used as digital outputs.
To change analog outputs over to digital outputs, enter command 11 into R 600y30101.

No.	Register	Pin (y = 1)	Pin (y = 2)
1	R 600y00231	X119.15	X219.15
2	R 600y00232	X119.16	X219.16
3	R 600y00233	X110.10	X210.10
4	R 600y00234	X110.11	X210.11

R 600y0023x

Value of analog output x as digital output value

Once the analog output x has been changed over to a digital output, the value in this register is output as digital value (bit).

Register properties		
Values	0	Output level is low
	1	Output level is high

Assignment of PWM outputs to registers

PWM outputs can also be used as digital outputs.
To change PWM outputs over to digital outputs, enter command 11 into R600y40101.

No.	Register	Pin (y = 1)	Pin (y = 2)
1	R 600y00241	X119.24	X219.24
2	R 600y00242	X119.25	X219.25
3	R 600y00243	X119.26	X219.26
4	R 600y00244	X119.27	X219.27
5	R 600y00245	X118.34	X218.34
6	R 600y00246	X118.35	X218.35
7	R 600y00247	X110.12	X210.12
8	R 600y00248	X110.13	X210.13

R 600y0024x

Value of PMW output x as digital output value

Once the PWM output x has been changed over to a digital output, the value in this register is output as digital value (bit).

Register properties		
Values	0	Output level is low
	1	Output level is high

Related topics

- **Connecting digital outputs** (see page 70)

8.3.2 Digital input 1 ... 11

Introduction

This chapter describes how to use digital inputs.
The application program lets you configure each digital input as Active-High input or as Active-Low input. Depending on the configuration the input channel may be inverted.

Analog inputs as digital inputs

Command 11 lets you switch over analog inputs 1 ... 4 to digital inputs. If this function is used, the following thresholds apply:

- All voltages at the analog input falling below 60 % of battery voltage are regarded as logic 0.
- All voltages at the analog input exceeding 60 % of battery voltage are regarded as logic 1.
- All currents at the analog input falling below 12 mA (60 % the maximum value of 20 mA) are regarded as logic 0.
- All currents at the analog input exceeding 12 mA (60 % the maximum value of 20 mA) are regarded as logic 1.

To disable this function use command 12.

Use of placeholders

The table below shows how placeholders are used to address individual digital inputs. The following values are possible:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 11	Digital input 1 ... 11

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Switching a digital input: Active-low or active-high.

Exceptions with regard to addressing

Take into account that addressing differs depending on the value of x.

If ...	... then ...
... x < 10 (x = 1 ... 9),	... use R 600y0015x.
... x = 10,	... use R 600y00160.
... x = 11,	... use R 600y00161.

Switching statuses

Depending on the configuration (active-low or active-high) in register R 600y0015x the following switching statuses are possible:

Configuration	Signal	R 600y0015x
0 = Active-low input	n.c.	0
	24 V	0
	0 V	1
1 = Active-high input	n.c.	0
	0 V	0
	24 V	1

Note:
"n.c." is short for "not connected".

R 600y0015x

Mode of digital inputs 1 ... 9

This value lets you define the operating mode of the digital inputs 1 ... 9: Active-low or active-high.

Register properties		
Values	0	Input in active-low mode
	1	Input in active-high mode

R 600y00160

Mode of digital input 10

This register lets you define the operating mode of digital input 10: Active-low or active-high.

Register properties		
Values	0	Input in active-low mode
	1	Input in active-high mode

R 600y00161

Mode of digital input 11

This register lets you define the operating mode of digital input 11: Active-low or active-high.

Register properties		
Values	0	Input in active-low mode
	1	Input in active-high mode

Registers for retrieving digital values

Assignment of digital inputs to registers

The table below lists the registers and the assigned digital inputs.

Number	Register	Pin (y = 1)	Pin (y =2)
1	R 600y00101	X119.05	X219.05
2	R 600y00102	X119.04	X219.04
3	R 600y00103	X119.03	X219.03
4	R 600y00104	X118.25	X218.25
5	R 600y00105	X118.26	X218.26
6	R 600y00106	X118.27	X218.27
7	R 600y00107	X118.30	X218.30
8	R 600y00108	X118.31	X218.31
9	R 600y00109	X118.32	X218.32
10	R 600y00110	X118.23	X218.23
11	R 600y00111	X118.22	X218.22

R 600y001xx

Mode of digital input xx = 1 ... 11

The value in this register is retrieved as digital value (bit).

Register properties		
Values	0	Input level is low
	1	Input level is high

Related topics

- **Connecting digital inputs** (see page 67)
- **Connecting digital frequency/pulse inputs** (see page 65)

Registers for retrieving analog values as digital values

Introduction

The JCM-350-E01/E02 lets you use analog inputs as digital inputs.

It also lets you set the operating point of each analog input through the corresponding "Mode" register.

Use of placeholders

The table below shows how placeholders are used to address individual analog inputs. In the following topics the rules below do apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 4	Analog input as digital input 1 ... 4

R 600y20x05

Analog input - Mode register

This register lets you define the mode for hardware processing.

Register properties		
Values	0	0 V ... 10V
	1	0 V ... 32V
	2	0 mA ... 20 mA
	3	4 mA ... 20 mA
	4	Ratiometric measurement

Analog inputs - Threshold values

The threshold is set to 60 % of the maximum value.

For current measurements this threshold is a fixed value, for voltage measurements it depends on the applied supply voltage.

Parameter	Description
Voltage	60 % of supply voltage
Current	60 % of the maximum value of 20 mA = 12 mA

Evaluation of analog inputs used as digital inputs may differ depending on their mode.

If ...	... and ...	... then ...
... the mode is 0 ... 10 V,	... the measured analog value is < 60 % of supply voltage,	... the level is considered as digital "low".
... the mode is 0 ... 10 V,	... the measured analog value is > 60 % of supply voltage,	... the level is considered as digital "high".
... the mode is 0 ... 32 V,	... the measured analog value is < 60 % of supply voltage,	... the level is considered as digital "low".
... the mode is 0 ... 32 V,	... the measured analog value is > 60 % of supply voltage,	... the level is considered as digital "high".
... the mode is 0 ... 20 mA,	... the measured analog value is < 12 mA,	... the level is considered as digital "low".
... the mode is 0 ... 20 mA,	... the measured analog value is > 12 mA,	... the level is considered as digital "high".
... the mode is 4 ... 20 mA,	... the measured analog value is < 12 mA,	... the level is considered as digital "low".
... the mode is 4 ... 20 mA,	... the measured analog value is > 12 mA,	... the level is considered as digital "high".
... the mode is ratiometric,	... the measured analog value is < 60 % of supply voltage,	... the level is considered as digital "low".
... the mode is ratiometric,	... the measured analog value is > 60 % of supply voltage,	... the level is considered as digital "high".

R 600y00121

Analog input 1 - Digital values

The value in this register is treated as digital value (bit) from analog input 1.

Register properties		
Values	0	Signal is < 60 % of maximum value
	1	Signal is > 60 % of maximum value

R 600y00122

Analog input 2 - Digital values

The value in this register is treated as digital value (bit) from analog input 2.

Register properties		
Values	0	Signal is < 60 % of maximum value
	1	Signal is > 60 % of maximum value

R 600y00123

Analog input 3 - Digital values

The value in this register is treated as digital value (bit) from analog input 3.

Register properties		
Values	0	Signal is < 60 % of maximum value
	1	Signal is > 60 % of maximum value

R 600y00124

Analog input 4 - Digital values

The value in this register is treated as digital value (bit) from analog input 4.

Register properties		
Values	0	Signal is < 60 % of maximum value
	1	Signal is > 60 % of maximum value

Related topics

- **Connecting analog inputs** (see page 59)

8.3.3 Digital input 12 ... 15 (frequency input)

Introduction

This chapter describes how digital frequency inputs are used.
You cannot set these inputs as they are active-low inputs.

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Description of Registers: Retrieving frequency inputs

Register Addressing

The table below shows how placeholders are used to address individual frequency inputs. Throughout this chapter the following rules apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2

R 600y00112

Value of digital frequency input 1

This input can be regarded as logical input # 12. The physical input is frequency input # 1.

Register properties		
Values	0	Input level is low
	1	Input level is high

R 600y00113

Value of digital frequency input 2

This input can be regarded as logical input # 13. The physical input is frequency input # 2.

Register properties		
Values	0	Input level is low
	1	Input level is high

R 600y00114

Value of digital frequency input 3

This input can be regarded as logical input # 14. The physical input is frequency input # 3.

Register properties		
Values	0	Input level is low
	1	Input level is high

R 600y00115

Value of digital frequency input 4

This input can be regarded as logical input # 15. The physical input is frequency input # 4.

Register properties		
Values	0	Input level is low
	1	Input level is high

Related topics

- **Connecting digital frequency/pulse inputs** (see page 65)

8.3.4 Frequency measurement

Introduction

This chapter describes how to carry out frequency and pulse measurements using the JCM-350-E01/E02.

The JCM-350-E01/E02 lets you toggle between pulse and frequency measurement using simple commands.

Use of placeholders

The table below shows how placeholders are used to address individual frequency inputs 1 ... 4. Throughout this chapter the following rules apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 4	Frequency inputs 1 ... 4

Frequency bands

Frequency measurement is split into the following two frequency bands:

- 0.5 Hz ... 500 Hz
- 500 Hz ... 50 kHz

For lower frequencies between 0.5 Hz and 500 Hz the period length is displayed in microseconds (µs). Frequency measurements in the frequency band between 500 Hz and 50 kHz are displayed in Hertz (Hz).

The latter is the default setting.

Toggling between frequency bands

The frequency measurement function lets you toggle between low and high frequency band. If the frequency is higher than 1 kHz, this function automatically switches over to the higher frequency band of 500 Hz ... 50 kHz.

Frequency	Period	Register	Display
0.5 Hz	2 s	600y43x05	2,000,000
250 Hz	4 ms	600y43x05	4,000
500 Hz	2 ms	600y43x05	2,000
1 kHz	1 ms	600y43x05	-1
500 Hz	2 ms	600y43x03	500
20 kHz	50 µs	600y43x03	20,000
50 kHz	20 µs	600y43x03	50,000
60 kHz	16.67 µs	600y43x03	-1

Measuring the pulse width

Command 12 lets you activate the mode "pulse width measurement". Register R 600y43x08 lets you set the resolution (in microseconds) for pulse width measurements.

R 600y43x08	Resolution in µs	Maximum period in ms
8	1	8.191
65	2	65.535
262	8	262
1048	32	1047

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Description of Registers: Frequency measurement

R 600y43x00

Status of frequency input x

The status indicates which mode is active at the moment.

R600y43x00	
Bit 1	**Period overflow for pulse width measurement** 1 = Period overflow for ■ pulse width measurement ■ frequency band 0.5 Hz ... 500 Hz
Bit 2	**Period overflow for frequency measurement 1 kHz ... 60 kHz** 1 = Overflow has occured: The measured frequency exceeds 60 kHz
Bit 10	**Measuring range 0.5 Hz ... 500 Hz is enabled** 1 = Status bit: Measuring range 0.5 Hz ... 500 Hz is enabled
Bit 11	**Measuring range 500 Hz ... 50 kHz is enabled** 1 = Status bit: Measuring range 500 Hz ... 50 kHz is enabled
Bit 12	**Pulse width measurement is enabled** 1 = Pulse width measurement is enabled

Register properties	
Type of access	Read access

R 600y43x01

Frequency input - Commands

Commands let you select low or high frequency band or pulse width measurement.

Command register	
10	Command 10 lets you activate frequency band 0.5 Hz ... 500 Hz.
11	Command 11 lets you activate frequency band 500 Hz ... 50 kHz.
12	Command 12 lets you activate pulse width measurement. Command 10 or 11 lets you go back to frequency measurement.
22	Command 22 lets you clear all error bits in R 600y43x00.

R 600y43x02

Pulse counter

The pulse counter lets you count the number of received pulses per input x.

Register properties	
Values	Pulses at frequency input x

R 600y43x03

Measured frequency

This register shows the frequency in Hz per input x for higher frequencies.

If the measurement is outside the allowed frequency band, the following rules apply:

- If the frequency is < 10 Hz, this register indicates the value 0.
- If the frequency is > 60 kHz, this register indicates the value -1.

Register properties	
Values	500 ... 50,000 for values ranging from 500 Hz ... 50 kHz
Type of access	Read access

R 600y43x05

Measured period length in microseconds per input x

This register shows the period in µs per input x for lower frequencies.

If the frequency at input x is higher than 1 kHz, register R 600y43x05 displays value -1. The device automatically switches over to the higher frequency band. If at input x no signal is received or the signal is slower than the timeout set in R 600y43x06, period length 0 is displayed.

Register properties	
Values	2,000,000 ... 2,000 for values ranging from 0.5 Hz ... 500 Hz
Type of access	Read access

R 600y43x06

Timeout

This register lets you define a timeout. If the measured channel no longer receives pulses, the period becomes infinitely great. R 600y43x06 lets you define a value (a multiple of 100 ms) limiting the period length.

Example:

A timeout of 5 seconds is to be set for frequency input 1.

Solution:

Enter value 50 into R 600y43106.

If frequency input 1 receives no signal for more than 5 seconds, the registers below contain the following values:

- R 600y43103 contains value 0.
- R 600y43105 contains value 0.

Register properties	
Values	32 bits
Increment	100 ms

R 600y43x07

Measured pulse width in microseconds per input x

This register shows the pulse width in µs per input x. Enter command 12 into R 600y43x01, to trigger pulse width measurement. Register R 600y43x08 lets you configure pulse width measurement.

Register properties	
Values	32 bits
Type of access	Read access

R 600y43x08

Pulse width configuration

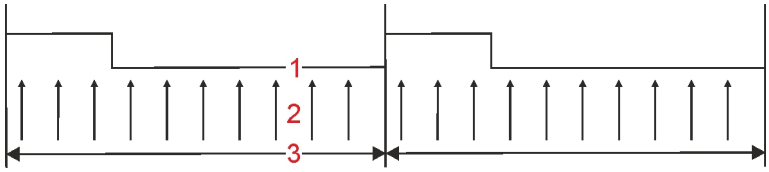
This register lets you configure the resolution for pulse width measurement. Resolution means the minimum internal time interval used by JCM-350-E01/E02 for pulse width measurement. The measuring range is independent of the output value in R 600y43x07.

Value	Resolution	Maximum measurable period length
8	1 µs	8.192 ms
65	2 µs	65.535 ms
262	8 µs	262 ms
1048	32 µs	1,047 ms

Register properties	
Takes effect	Once a value has been entered into the register.

Example:

Set the value in R 600y43x08 to 262. The resolution has been set to 8 µs. Thus, the frequency input picks up signal level changes at an interval of 8 µs. The maximum measurable period length is a time interval; in the given case 262 ms.



Number	Description
1	Any pulse at the frequency input
2	Resolution: here sampling interval of 8 µs
3	Maximum period length of measurement: here 262 ms

Related topics

- **Connecting digital frequency/pulse inputs** (see page 65)

8.3.5 PWM outputs 1 ... 8

Introduction

This chapter describes how to use the PWM feature.

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Description of Registers: PWM outputs 1 ... 8	211

Description of Registers: PWM outputs 1 ... 8

Addressing PWM registers

The table below shows how placeholders are used to address PWM outputs 1 ... 8. Throughout this chapter the following rules apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 8	PWM output 1 ... 8

Example:

Addressing the setpoint (0 ... 100 %) of pulse width modulation for output 5 on I/O module 2:

R 600240503

R 600y40000

Status register of all 8 PWM outputs

This register indicates the status of the PWM outputs in bit-coded format.

Meaning of the individual bits		
Bit 1	**Status of PWM output 1**	
	1 =	Output is overloaded
Bit 2	**Status of PWM output 2**	
	1 =	Output is overloaded
Bit 3	**Status of PWM output 3**	
	1 =	Output is overloaded
Bit 4	**Status of PWM output 4**	
	1 =	Output is overloaded
Bit 5	**Status of PWM output 5**	
	1 =	Output is overloaded
Bit 6	**Status of PWM output 6**	
	1 =	Output is overloaded
Bit 7	**Status of PWM output 7**	
	1 =	Output is overloaded
Bit 8	**Status of PWM output 8**	
	1 =	Output is overloaded

Register properties	
Type of access	Read access

R 600y40001

Command register for all 8 PWM outputs

The global command register lets you clear the status "Overload" for all 8 PWM outputs.

Command	
11	**Enable PWM mode for digital output**
12	**Disable PWM mode for digital output**
22	**Clear the status "Overload" for all 8 PWM outputs**

R 600y40x00

Status register of PWM output x

This status register indicates whether PWM is enabled or disabled.

Register properties		
Values	Bit 0 = 0	PWM disabled
	Bit 0 = 1	PWM enabled

R 600y40x01

Command register of PWM output x

This command register lets you enable or disable PWM output x.

Commands	
1	**Enable PWM**
2	**Disable PWM**

R 600y40x02

Period length of PWM output x

This register lets you set the period length for the PWM function.

Register properties		
Values	12,000 ... 2,147,483,647	48,000 corresponds to a period length of 1 ms. The period length may range from 250 µs to 44 s.

R 600y40x03

Setpoint of PWM output x

This register lets you define the setpoint. To set this value to its maximum (100 %), enter the value contained in register R 600y40x02 (maximum period length) into register R 600y40x03.

Register properties		
Values	0 ... <R 600y40x02>	0 ... 100 % of R 600y40x02

Related topics

- **Connecting PWM outputs** (see page 75)

8.3.6 Relay outputs 1 ... 4

Introduction

This chapter describes how to use and program relay outputs.

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Description of Registers: Relay outputs 1 ... 4

Addressing relay outputs

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 4	Relay output 1 ... 4

R 600y0025x

Relay output x

This register lets you enable or disable relay x in bit-coded format.

Register properties		
Value	0	Relay x disabled
	1	Relay x enabled

8.3.7 H-bridges 1 ... 2

Introduction

This chapter describes how to use and program H-bridges.

- Depending on the application, you may use the H-bridge in digital or in analog mode. A simple command lets you toggle between digital and analog H-bridge mode.
- The default H-bridge setting is analog mode.

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Description of Registers: H-bridge	217

Description of Registers: H-bridge

Addressing the H-bridge

The table below shows how placeholders are used to address an H-bridge. Throughout this chapter the following rules apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 2	H-bridge 1 ... 2

Example:

To address the period length of the second H-bridge on I/O module 2, enter the following register number

R 600242202

Commissioning an H-bridge in analog mode

To commission an H-bridge in analog mode, proceed as follows:

Step	Action
1	Set the **period length** in R 600y42102, and R 600y42202, e. g. by entering value 48,000 into R 600y42102, and value 50,000 into R 600y42202.
2	To **activate** the H-bridge, enter command 1 into R 600y42x01.
3	Enter the desired **setpoint** into R 600y42x03. For example, a setpoint ranging from -48,000 ... +48,000 for H-bridge 1, and a setpoint ranging from -50,000 ... +50,000 for H-Bridge 2.
⇨	**Result**: H-bridge 1 is controlled at a rate of 50 % in positive direction. H-bridge 2 is controlled at a rate of 25.6 % in negative direction.

Commissioning an H-bridge in digital mode

To commission an H-bridge as digital output, proceed as follows:

Step	Action	
1	Enter command 11 into R 600y42x01 to switch over the H-bridge to "digital mode".	
2	Depending on direction and behavior, configure the output as follows:	
	If ...	**... then ...**
	... you wish to configure H-bridge x as high-side output, right-hand,	... enter command 13 into R 600y42x01.
	... you wish to configure H-bridge x as low-side output, right-hand,	... enter command 14 into R 600y42x01.
	... you wish to configure H-bridge x as high-side output, left-hand,	... enter command 15 into R 600y42x01.
	... you wish to configure H-bridge x as low-side output, left-hand,	... enter command 16 into R 600y42x01.
3	To enable H-bridge x, enter command 1 into R 600y42x01.	
⇨	H-bridge configuration is completed.	

Step	Action
4	Registers R 600y00261 ... R 600y00264 let you enable or disable H-bridge x.

R 600y42x00

H-bridge status

This register indicates the status of the H-bridges in bit-coded format.

Meaning of the individual bits		
Bit 0	**H-bridge enabled or disabled**	
	0 =	H-bridge is disabled
	1 =	H-bridge is enabled
Bit 2	**Direction**	
	0 =	Negative direction
	1 =	Positive direction
Bit 3	**Overload monitoring enabled or disabled**	
	0 =	Overload monitoring is disabled
	1 =	Overload monitoring is enabled
Bit 4	**I^2t overload monitoring**	
	0 =	No I²t overload
	1 =	I^2t overload is present If this bit is set, the I²t value exceeds its limit. As a result, the output (H-bridge) gets disabled.
Bit 5	**H-bridge as digital output**	
	0 =	The H-bridge is set to a value between 0 ... 100 %.
	1 =	H-bridge is configured to output 0 % or 100 %
Bit 6	**H-bridge as digital output, right**	
	0 =	Low-side output, right
	1 =	High-side output, right
Bit 7	**H-bridge as digital output, left**	
	0 =	Low-side output, left
	1 =	High-side output, left

Register properties	
Type of access	Read access

R 600y42x01

Command register - H-bridges

This command register lets you set the H-bridge mode (digital or analog) and select the direction (positive or negative).

Commands	
1	**Enable H-bridge x**
2	**Disable H-bridge x**
11	**Enable mode "Digital output" for H-bridge x (fixed PWM setpoint of 100%)**
12	**Disable mode "Digital output" for H-bridge x**
13	**Enable mode "Digital output" for H-bridge x, low-side output, right**
14	**Enable mode "Digital output" for H-bridge x, high-side output, right**
15	**Enable mode "Digital output" for H-bridge x, low-side output, left**
16	**Enable mode "Digital output" for H-bridge x, high-side output, left**
20	**Positive direction**
21	**Negative direction**
22	**Acknowledge overload (clear short-circuit and I^2t trip)**

R 600y0026x

Setting/resetting the H-bridge as digital output

Once you have configured the H-bridge as digital output, you can set/reset the corresponding output in register R 600y00261 ... R 600y00264.

If you enter the value 1 into one of these registers, the corresponding H-bridge is set as digital output. If you enter 0 into this register, the H-Bridge is reset.

Note:

It is **not** possible to set/reset the H-bridge as digital output in register R 600y42x03 **H-bridge setpoint**.

Register	Description
R 600y00261	H-bridge 1, right
R 600y00262	H-bridge 1, left
R 600y00263	H-bridge 2, right
R 600y00264	H-bridge 2, left

Note on "Analog mode"

If a signed setpoint is used, commands 20 and 21 are not required.

R 600y42x02

H-bridge period length

This register lets you set the period length of the H-bridge.

Register properties		
Values	12,000 ... 2,147,483,647 20,833 ns	48,000 corresponds to a period length of 1 ms. The period length may range from 250 µs to 44 s.

R 600y42x03

H-bridge setpoint

This register lets you define the setpoint of the H-bridges (+/- | 0 ... 100 % |). For example, to set this value to its maximum (100 %), enter the value contained in register R 600y40x02 (maximum period length) into register R 600y40x03.

Evaluation of register 600y42x03 is sign-dependent. A positive value causes the motor to rotate forwards. A negative value causes the motor to rotate backwards.

Register properties		
Values	+/- | 0 ... maximum in <R 600y42x02> |	-100 % ... 100 %

R 600y42x06

H-bridge I^2t overcurrent protection

This register shows the average power dissipation of the H-bridge. The I^2t calculation is based on a model that is in proportion to the actual power dissipation.

Register properties		
Values	0 ... 100	0 % ... 100 %

R 600y22903

Current measurement - H-bridge 1

Register R 600y22903 shows the current for H-bridge 1 in mA.

Register properties		
Values	Displayed in mA	e. g. 1,000 representing 1 A

R 600y23003

Current measurement - H-bridge 2

Register R 600y23003 shows the current for H-bridge 2 in mA.

Register properties		
Values	Displayed in mA	e. g. 1,000 representing 1 A

Related topics

- **Connecting H-bridges** (see page 73)

8.4 Programming analog inputs and outputs

Introduction

This chapter describes how analog voltage and current signals are processed.

Independency

Each analog input and output can be configured regardless of the configuration of the other analog inputs and outputs.

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A/D converter - Converting electrical signals into digital values	223
D/A conversion - Converting digital values into electrical signals	229

8.4.1 A/D converter - Converting electrical signals into digital values

Introduction

This chapter describes how electrical signals are converted into digital values.

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Converting analog voltages into digital values	224
Configuring A/D conversion for several measuring ranges	225
Description of Registers: Converting analog values into digital values	226
Description of Registers: Analog current/voltage values	228

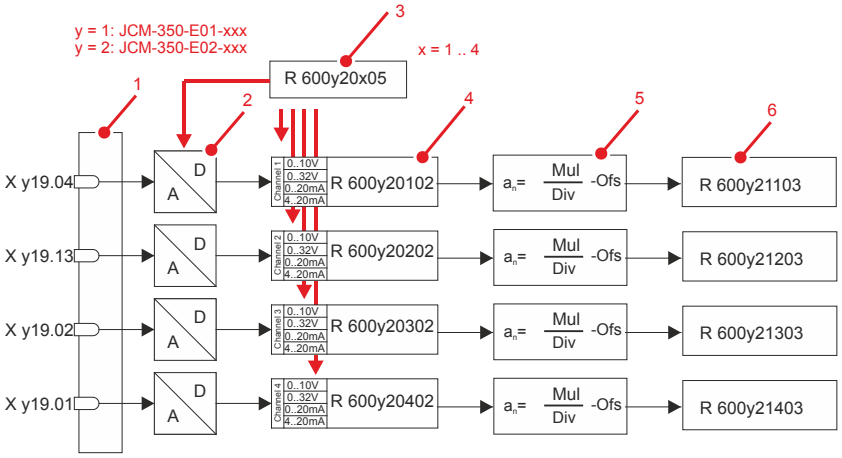
Converting analog voltages into digital values

Introduction

The A/D converter converts electrical levels at analog inputs of pin X119 and X219 to digital values.

A/D conversion

The illustration below shows the process of A/D conversion. Register R 600y20x05 lets you configure individual channels.



No.	Description
1	Connector X119 or connector X219
2	Individual A/D conversion, 12-bit; values 0 ... 4,095
3	R 600y20x05 for selecting the corresponding channel
4	R 600y20x02 containing the uncalibrated result
5	Calibration depending on mode
6	R 600y20x03 containing the calibrated result. Where x = 1 ... 4

Configuring A/D conversion for several measuring ranges

Introduction: Configuration

Analog inputs can be configured as shown below:

- 0 V ... +10 V
- 0 V ... +32 V
- 0 mA ... 20 mA
- 4 mA ... 20 mA
- Ratiometric voltage measurement: measured voltage / battery voltage x 1,000

Register R 600y20x05 lets you define the input circuit per channel.

The ratiometric voltage value is the ratio between measured voltage and supply voltage (battery). The ratio, for example, is 500 if the measured voltage is 12 V and the battery voltage is 24 V.

Jetter AG ships the JCM-350-E01/E02 as a calibrated device.

Addressing analog inputs

The table below shows how placeholders are used to address analog inputs 1 ... 4. Throughout this chapter the following rules apply:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 4	Analog input 1 ... 4

R 600y20x05

Configuring analog input x

This register lets you configure how input signals are processed. This register lets you define the mode for hardware processing.

Register properties		
Values	0	0 V ... 10V
	1	0 V ... 32V
	2	0 mA ... 20 mA
	3	4 mA ... 20 mA
	4	Ratiometric measurement

Description of Registers: Converting analog values into digital values

R 600y20x00

Status of analog input x

If the mode is "4 ... 20 mA", this register shows whether the value is less than 4 mA. This feature lets you detect no-load conditions, such as a broken cable. This bit is set if the current falls below 4 mA. If you enter the value 0 into register R 600y20x00, the bit is cleared.

Register properties		
Values	Bit 0 = 1	The value in R 600y20x03 is less than 4,000, i.e. 4 mA

R 600y20x03

Value of the measured input signal

This register contains the measured physical value of the analog input depending on the set mode.

Register properties	
Values	The content of this register depends on the mode set.

R 600y20x05

Configuring the A/D channel

To switch over the configuration of analog input x, enter a value between 0 ... 4 into register R 600x20x05.

Register properties

Register	Values	Configuration
R 600y20x05 = 0	0 ... 10,000	0 ... 10 V
R 600y20x05 = 1	0 ... 32,000	0 ... 32 V
R 600y20x05 = 2	0 ... 20,000	0 ... 20 mA
R 600y20x05 = 3	0 ... 20,000	4 ... 20 mA
R 600y20x05 = 4	0 ... 1,000	Ratiometric

Related topics

- **Connecting analog inputs** (see page 59)

Description of Registers: Analog current/voltage values

Adressing module-internal currents/voltages

This device monitors module-internal currents and voltages. To address the analog inputs for current and voltage measurement, use the following placeholders:

Placeholder	Value	Purpose
y	1 ... 2	I/O module 1 ... 2
x	21	Current of digital output 1
x	22	Current of digital output 2
x	23	Current of digital output 3
x	24	Current of digital output 4
x	25	Current of digital output 5
x	26	Current of digital output 6
x	27	Current of digital output 7
x	28	Current of digital output 8
x	29	Current of H-bridge 1
x	30	Current of H-bridge 2
x	31	Voltage of digital output 1
x	32	Voltage of digital output 2
x	33	Voltage of digital output 3
x	34	Voltage of digital output 4

Representation of units

All current values are displayed in millivolts. That is, a value of 9,150 corresponds to a voltage of 9,150.00 mA.

All voltage values are displayed in millivolts. That is, a value of 1234 corresponds to a voltage of 1,234.00 mV.

R 600y2xx03

Calibrated value of the measured input signal

This register contains the measured physical value.

The value that is output by register R 600y22x03 is converted according to the set mode.

Register properties		
Values	The output value depends on the channel.	Current inputs are set to mA; voltage inputs are set to mV.

8.4.2 D/A conversion - Converting digital values into electrical signals

Introduction

This chapter describes how digital values are converted into electrical signals. You can configure D/A conversion as follows:

- Analog output
- Digital output

An analog value is output either as minimum, or as maximum.

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Registers for digital-to-analog conversion	231

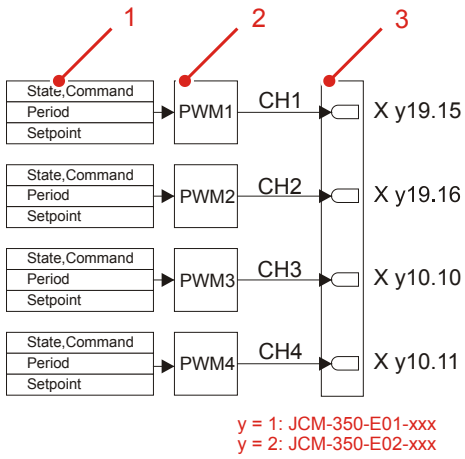
Digital/analog conversion

Introduction

The D/A converter converts digital values into analog voltages.

D/A conversion

The illustration below shows how D/A conversion works:



No.	Description
1	Registers for configuring the related D/A channel
2	The underlying D/A conversion
3	Analog output pins, e.g. X210.10 (channel 3)

Registers for digital-to-analog conversion

Addressing analog outputs

Placeholder	Values	Purpose
y	1 ... 2	I/O module 1 ... 2
x	1 ... 4	D/A channel 1 ... 4
z	0	Status
z	1	Command
z	3	Set value
z	5	Mode switching

Addressing an D/A output

Addressing an output	
600y30x0z	where x = 1 - D/A output 1
600y30x0z	where x = 2 - D/A output 2
600y30x0z	where x = 3 - D/A output 3
600y30x0z	where x = 4 - D/A output 4

Example:

D/A output 3 on I/O module 2 is to be set to 16 V:

```
600230303 := 16000;
```

Switching over from analog to digital output

Command 11 lets you switch over from analog output mode to digital. If the output mode of the D/A converter has been set to digital, the output value is either 0, or 1.

Command 12 lets you switch over from digital to analog output mode.

R 600y30x00

Status of D/A output x

This register returns the status of D/A conversion for output x.

Register properties		
Values	Bit 0 = 0	Analog output disabled
	Bit 0 = 1	Analog output enabled

R 600y30x01

Command register for D/A conversion

This register lets you enable, disable or switch over D/A conversion.

Commands	
1	**Enable mode "Analog output"**
2	**Disable mode "Analog output"**
11	**Switch over from mode "Analog output" to "Digital output": The analog value is output either as 0, or maximum value.**
12	**Disable mode "Digital output"**

R 600y30x03

Register "Setpoint" for D/A output x

This register contains the setpoint

Register properties		
Values	0 ... 10,000	0 ... 10 V
	0 ... 32,000	0 ... 32 V

R 600y30x05

Mode 0 ... 10 V or 0 ... 32 V

This register lets you select the mode. To enable a voltage output of up to 32 V, enter 1.

Register properties		
Values	0	0 ... 10 V
	1	0 ... 32 V

Related topics

- **Connecting analog outputs** (see page 61)

9 Betriebssystemupdate

Introduction

Jetter AG are continuously striving to enhance the operating systems for their controllers and peripheral modules. Enhancing means adding new features, upgrading existing functions and fixing bugs.

This chapters describes how to perform an operating system update for a system equipped with a JCM-350-E01/E02 controller.

Downloading an Operating System

You can download operating systems from the Jetter AG homepage at **www.jetter.de http://www.jetter.de**. You get to the OS files by clicking on the quick link "Operating System Download" on the website of the corresponding controller or module.

Mobile controllers

The operating system of the following mobile controllers can be updated:

- Controller JCM-350-E01/E02

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9.1 Updating the Operating System of the Controller

Introduction

This chapter describes how to update the OS of the controller JCM-350-E01/E02. To transfer the OS file to the controller the following options are available:

- From within the programming tool JetSym

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OS update by means of JetSym

Introduction

The programming tool JetSym offers an easy way to transfer an OS file to the JCM-350-E01/E02.

Prerequisites

- An OS file for the JCM-350-E01/E02 must be available.
- An active CAN connection between JetSym and the device is set up.
- During booting, the controller is waiting for the OS update (boot loader), or the OS is already running.
- The controller must not be de-energized during the OS update process.

Updating the OS

To update the OS, proceed as follows:

Step	Action
1	In JetSym, click on the menu **Build** and select item **Update OS...**, or click in the configuration window of the Hardware Manager on **OS Update**. **Result:** The file selection dialog opens.
2	Select the new OS file here. **Result:** In JetSym, a confirmation dialog opens.
3	Launch the OS upload by clicking the button **Yes**.
4	Wait until the update process is completed.
5	To activate the transferred OS, re-boot the controller.

10 Quick reference - JCM-350

Operating system version

This quick reference summarizes the registers and flags of the controller JCM with OS version 1.12.0.06

General overview - Registers

100000 ... 100999	Electronic Data Sheet (EDS)
101000 ... 101999	Configuration
200000 ... 209999	General system registers
210000 ... 219999	Application program
310000 ... 319999	File system / data files
1000000 ... 1005999	JCM-350: Application registers (remanent; Int/Float)

General overview - Flags

0 ... 255	Application flags (remanent)
256 ... 2047	Overlaid by registers 1000000 through 1000055
2048 ... 2303	Special flags

Electronic Data Sheet (EDS)

100500	Interface (0 = CPU)
[Identification]	
100600	Internal version number
100601	Module ID
100602 ...	Module name (register string)
100612	
100613	PCB revision
100614	PCB options
[Production]	
100700	Internal version number
100701 ...	Serial number (register string)
100707	
100708	Day
100709	Month
100710	Year
100711	TestNum.
100712	TestRev.
[Features]	**I/O Module**
100808	Features
100809	Diagnostics mask
[Features]	**JCM-350**
100800	Internal version number
100801	MAC Address (Jetter)
100802	MAC Address (device)
100803	Serial port
100804	Switch
100805	STX
100806	Remanent registers
100808	CAN bus
100811	Intelligent slave modules
100812	HTTP / e-mail
100813	Modbus/TCP
100817	RTC
100992	Item number
100993	Hardware revision of the device as a whole

Configuration

	From file /system/config.ini
101100	IP address
101101	Subnet mask
101102	Default gateway
101103	DNS server
101132	Host name suffix type
101133 ...	Host name (register string)
101151	
101164	JetIP port number
101165	STX debugger port number
	Used by the system
101200	IP address
101201	Subnet mask
101202	Default gateway
101203	DNS server
101232	Host name suffix type
101233 ...	Host name (register string)
101251	
101264	JetIP port number
101265	STX debugger port number

General system registers

200000	OS version (major * 100 + minor)
200001	Application program is running (bit 0 = 1)
200008	Error register (identical with 210004)
	Bit 1: Error on JX3 bus
	Bit 2: Error on JX2 bus
	Bit 8: Illegal jump
	Bit 9: Illegal call
	Bit 10: Illegal index
	Bit 11: Illegal opcode
	Bit 12: Division by 0
	Bit 13: Stack overflow
	Bit 14: Stack underflow
	Bit 16: Error when loading application program
	Bit 24: Timeout - cycle time
	Bit 25: Timeout - task lock
	Bit 31: Unknown error
200168	Bootloader version (IP format)
200169	OS version (IP format)
200170	Controller type (340/350)
201000	Runtime registers in milliseconds (rw)
201001	Runtime registers in seconds (rw)
201002	Runtime register in register 201003 Units (rw)
201003	* 10 ms units for register 201002 (rw)
201004	Runtime registers in milliseconds (ro)
202930	Web status (bit-coded)
	Bit 0 = 1: FTP server available
	Bit 1 = 1: HTTP-server available
	Bit 2 = 1: E-mail available
	Bit 3 = 1: Data file function available
	Bit 4 = 1: Modbus/TCP has been licensed
	Bit 5 = 1: Modbus/TCP available
	Bit 6 = 1: Ethernet/IP available
202936	Control register - File System 0xc4697a4b: Formatting the flash disk
202960	Password for system command register (0x424f6f74)
202961	System command register

202980	Error history: Number of entries
202981	Error history: Index
202982	Error history: Entry
203000	Interface monitoring: JetIP
203001	Interface monitoring: SER
203005	Interface monitoring: Debug server
203100 ... 203107	32-bit overlaying - Flag 0 ... 255
203108 ... 203123	16-bit overlaying - Flag 0 ... 255
203124 ... 203131	32-bit overlaying - Flag 2048 ... 2303
203132 ... 203147	16-bit overlaying - Flag 2048 ... 2303
209700	System logger: Global enable
209701 ... 209739	Enabling system components

Application program

210000	Application program is running (bit 0 = 1)
210004	Error register (bit-coded) Bit 1: Error on JX3 bus Bit 2: Error on JX2 bus Bit 8: Illegal jump Bit 9: Illegal call Bit 10: Illegal index Bit 11: Illegal opcode Bit 12: Division by 0 Bit 13: Stack overflow Bit 14: Stack underflow Bit 15: Illegal stack Bit 16: Error when loading application program Bit 24: Timeout - cycle time Bit 25: Timeout - task lock Bit 31: Unknown error
210006	Highest task number
210007	Minimum program cycle time
210008	Maximum program cycle time
210009	Current program cycle time
210011	Current task number
210050	Current program position within a execution unit
210051	ID of the execution unit being processed
210056	Desired total cycle time in µs
210057	Calculated total cycle time in µs
210058	Maximum time slice per task in µs
210060	Task ID (for register 210061)
210061	Task priority for the task [reg. 210060]
210063	Length of scheduler table
210064	Index in scheduler table
210065	Task ID in scheduler table
210070	Task ID (for register 210071)
210071	Timer number (0 ... 31)
210072	Manual triggering of a timer event (bit-coded)
210073	End of cyclic task (task ID)
210074	Command for cyclic tasks
210075	Number of timers
210076	Timer number (for register 210077)
210077	Timer value in milliseconds
210100 ... 210199	Task state
210400 ... 210499	Task - programm address
210600	Task ID of a cyclic task (for register 210601)
210601	Processing time of a cyclical task in per mil figure
210609	Task lock timeout in ms -1: Monitoring disabled
210610	Timeout (bit-coded, bit 0 -> timer 0, etc.)

File system / data file function

312977	Status of file operation
312978	Task ID

Application Registers

1000000 ... 1005999	JC-350: 32-bit integer or floating point number (remanent)

Special flags - Interface monitoring

2088	OS flag - JetIP
2089	User flag - JetIP
2090	OS flag - SER
2091	User flag - SER
2098	OS flag - Debug server
2099	User flag - Debug server

32 combined flags

203100	0 ... 31
203101	32 ... 63
203102	64 ... 95
203103	96 ... 127
203104	128 ... 159
203105	160 ... 191
203106	192 ... 223
203107	224 ... 255

16 combined flags

203108	0 ... 15
203109	16 ... 31
203110	32 ... 47
203111	48 ... 63
203112	64 ... 79
203113	80 ... 95
203114	96 ... 111
203115	112 ... 127
203116	128 ... 143
203117	144 ... 159
203118	160 ... 175
203119	176 ... 191
203120	192 ... 207
203121	208 ... 223
203122	224 ... 239
203123	240 ... 255

32 combined special flags

203124	2048 ... 2079
203125	2080 ... 2111
203126	2112 ... 2143
203127	2144 ... 2175
203128	2176 ... 2207
203129	2208 ... 2239
203130	2240 ... 2271
203131	2272 ... 2303

16 combined special flags

203132	2048 ... 2063
203133	2064 ... 2079
203134	2080 ... 2095
203135	2096 ... 2111
203136	2112 ... 2127
203137	2128 ... 2143
203138	2144 ... 2159
203139	2160 ... 2175
203140	2176 ... 2191
203141	2192 ... 2207
203142	2208 ... 2223
203143	2224 ... 2239
203144	2240 ... 2255
203145	2256 ... 2271
203146	2272 ... 2287
203147	2288 ... 2303

Overlaid application registers/flags

1000000	256 ... 287
1000001	288 ... 319
1000002	320 ... 351
1000003	352 ... 383
1000004	384 ... 415
1000005	416 ... 447
1000006	448 ... 479
1000007	480 ... 511
1000008	512 ... 543
1000009	544 ... 575
1000010	576 ... 607
1000011	608 ... 639
1000012	640 ... 671
1000013	672 ... 703
1000014	704 ... 735
1000015	736 ... 767
1000016	768 ... 799
1000017	800 ... 831
1000018	832 ... 863
1000019	864 ... 895
1000020	896 ... 927
1000021	928 ... 959
1000022	960 ... 991
1000023	992 ... 1023
1000024	1024 ... 1055
1000025	1056 ... 1087
1000026	1088 ... 1119
1000027	1120 ... 1151
1000028	1152 ... 1183
1000029	1184 ... 1215
1000030	1216 ... 1247
1000031	1248 ... 1279
1000032	1280 ... 1311
1000033	1312 ... 1343
1000034	1344 ... 1375
1000035	1376 ... 1407
1000036	1408 ... 1439
1000037	1440 ... 1471
1000038	1472 ... 1503
1000039	1504 ... 1535
1000040	1536 ... 1567
1000041	1568 ... 1599
1000042	1600 ... 1631
1000043	1632 ... 1663
1000044	1664 ... 1695
1000045	1696 ... 1727
1000046	1728 ... 1759
1000047	1760 ... 1791
1000048	1792 ... 1823
1000049	1824 ... 1855
1000050	1856 ... 1887
1000051	1888 ... 1919
1000052	1920 ... 1951
1000053	1952 ... 1983
1000054	1984 ... 2015
1000055	2016 ... 2047

System Functions

4	Conversion from BCD to HEX
5	Conversion from HEX to BCD
20	Square root
21	Sine
22	Cosine
23	Tangent
24	Arc Sine
25	Arc cosine
26	Arc tangent
27	Exponential function
28	Natural logarithm
29	Absolute value
30	Separation of digits before and after the decimal point
60	CRC generation for Modbus RTU
61	CRC check for Modbus RTU
65/67	Reading register block via Modbus/TCP
66/68	Writing register block via Modbus/TCP
80/85	Initializing RemoteScan
81	Starting RemoteScan
82	Stopping RemoteScan
90	Writing data file
91	Appending data file
92	Reading data file
96	Deleting data file
110	E-mail feature
150	Configuring NetCopyList
151	Deleting NetCopyList
152	Sending NetCopyList

11 Quick reference - JCM-350-E01/E02, I/O module

Operating system version

This quick reference summarizes the registers of the **I/O modules** on a JCM-350-E01/E02 with OS version 1.00.0.76 or higher.

Placeholder definition

The register numbers used in this chapter contain placeholders. They make it easier to search for similar functions shifted by an offset.
The following rule applies:
y = 1 for I/O module 1
y = 2 for I/O module 2

Default addresses

The JCM-350-E01/E02 is shipped with the following default address:
Node ID: 127 (0x7F)

General overview - Registers

600y00000	Status of digital output: Bit 0 = 1: Collective message "Short circuit" Bit 1 ... Bit 8: Short circuit of digital output 1 ... 8
600y44000	Module state
600y44001	Module command
600y44010	Battery voltage
600y44030	BER_Signal
600000400.0	Status bit 0 = 1: Communication enabled - I/O module 1
600000400.1	Status bit 1 = 1: Communication enabled - I/O module 2
600000401	Command 11: Enabling communication - I/O module 1 Command 12: Enabling communication - I/O module 2
600000020 with	Launching STX program value 0 = Stop value 1 = Run value 2 = Load
600000010	Timeout counter - Data protocol
600000011	FCS error counter - Data protocol
104531	Changing the IP address (remanent)
104532	Changing the IP mask (remanent)
104533	Changing the IP gateway (remanent)

Description of registers - Control panel

600000312	Keyboard, bit-coded Bit 0 = 1: Key "F1" pressed Bit 7 = 1: Key "F8" pressed Bit 8 = 1: Key "Mode" pressed
600000320	LED green, bit-coded Bit 0 = 1: Node Bit 1 = 1: Supply Bit 2 = 1: Failure Bit 3 = 1: CAN5 Bit 4 = 1: CAN4 Bit 5 = 1: CAN3 Bit 6 = 1: CAN2 Bit 7 = 1: CAN1
600000321	LED red, bit-coded Bit 0 = 1: Node Bit 1 = 1: Supply Bit 2 = 1: Failure Bit 3 = 1: CAN5 Bit 4 = 1: CAN4 Bit 5 = 1: CAN3 Bit 6 = 1: CAN2 Bit 7 = 1: CAN1
600000322	LED green, bit-coded Bit 0 = 1: Run/Config/Teach
600000323	LED red, bit-coded Bit 0 = 1: Run/Config/Teach

Command register - I/O module

600y44001	Command register Command 1: Energizing all I/O components Command 2: De-energizing all I/O components Command 11: Enabling communication - I/O module 1 Command 12: Enabling communication - I/O module 2 Command 29: Clearing current error bits in R 600y44031

Basic address sorted by functional blocks

600y20102	Analog/digital conversion
600y30100	Digital/analog conversion
600y00201	Digital outputs
600y001xx	Digital inputs
600y43103	Frequency measurement
600y44000	Global registers
600y42100	H-bridge
600y40000	PWM outputs, digital
600y00251	Relay outputs

Analog inputs

600y20102	Input 1 - Results register
600y20202	Input 2 - Results register
600y20302	Input 3 - Results register
600y20402	Input 4 - Results register

Digital outputs

600y0000x	Overload I^2t - Output x
600y0020x	Output x 0 = Output disabled 1 = Output enabled x = 1 ... 8: Output 1 ... 8 y = 1: I/O module 1 y = 2: I/O module 2
600y0023x	Analog output 1 ... 4 as digital output x = 1 ... 4: Following switchover output can be used as digital output

600y0024x	PWM output as digital output x = 1 ... 8: Following switchover output can be used as digital output
600y01000	Status of I^2t overcurrent protection bit 1 ... 8
600y0100x	Value of I^2t overcurrent protection per output x x = 1 ... 8: Output 1 ... 8
600y01011	Command register for digital outputs Command 22: Reset short-circuit and I^2t

Digital inputs

600y001xx	Input xx Value 0: Enabling input (active-low) at 0 V Value 1: Disabling input (active-low) at 24 V or n.c. Value 0: Disabling input (active-high) at 0 V or n.c. Value 1: Enabling input (active-high) at 24 V Active-high: R 600y0015x = 1 Active-low: R 600y0015x = 0 Range R 600y00151 ... R 600y00161 n.c. = not connected xx = 1 ... 11: Input 1 ... 11 y = 1: I/O module 1 y = 2: I/O module 2

Frequency measurement

600y43x00	Frequency status Bit 1 = 1: Period overflow for pulse width measurement Measuring range 0.5 ... 500 Hz Bit 2 = 1: Overflow: The measured frequency exceeds 60 kHz Bit 10 = 1: Measuring range 0.5 Hz ... 500 Hz enabled Bit 11 = 1: Measuring range 500 Hz ... 50 kHz enabled Bit 12 = 1: Pulse-width measurement is enabled
600y43x01	Command register Command 10: Set measuring range to 0.5 ... 500 Hz Command 11: Set measuring range to 500 Hz ... 50 kHz Command 12: Enable pulse-width measurement Command 22: Clear all error bits in R 600y43x00
600y43x02	Pulse counter
600y43x03	Measured frequency in Hz
600y43x05	Measured period in µs
600y43x06	Timeout: 16-bit counter, unit is ms, e.g. 100 ms grid period limitation
600y43x07	Measured pulse width in µs
600y43x08	Pulse width configuration Value / Resolution / Measuring range 8 / 1 µs / 8,192 ms 65 / 2 µs / 65,535 ms 262 / 8 µs / 262 ms 1048 / 32 µs / 1,047 s x = 1 ... 4: Output 1 ... 4 Value range: 0.5 Hz ... 50 kHz

PWM outputs 1 ... 8

600y40x00	Global status register Bit 0 = 0: PWM disabled Bit 0 = 1: PWM enabled
600y40x01	Command register
600y40x02	PWM period length 48,000 corresponds to a period length of 1 ms.
600y40x03	PWM setpoint (0 ... 100 %) where x = 1 ... 8: Output 1 ... 8

Relay outputs 1 ... 4

600y00251	Relay output 1 Value 0: Relay output open Value 1: Relay output closed
600y00252	Relay output 2 Value 0: Relay output open Value 1: Relay output closed
600y00253	Relay output 3 Value 0: Relay output open Value 1: Relay output closed
600y00254	Relay output 4 Value 0: Relay output open Value 1: Relay output closed

H-bridge

600y42x00	H-bridge status register Bit 0 = 0: H-bridge disabled Bit 0 = 1: H-bridge enabled Bit 2 = 1: Positive Direction Bit 3 = 1: Short-circuit has occurred Bit 4 = 1: I^2t overload has occurred Bit 5 = 1: Mode: H-bridge as digital output Bit 6 = 0: H-bridge as digital output, low-side output right Bit 6 = 1: H-bridge as digital output, high-side output right Bit 7 = 0: H-bridge as digital output, low-side output left Bit 7 = 1: H-bridge as digital output, high-side output left
600y42x01	Command register Command 1: Enable bridge Command 2: Disable bridge Command 11: Enable mode: H-bridge as digital output Command 12: Disable mode: H-bridge as digital output Command 13: Configure digital output, low-side right Command 14: Configure digital output, high-side right Command 15: Configure digital output, low-side left Command 16: Configure digital output, high-side left Command 20: Direction = 1 Command 21: Direction = 0 Command 22: Clear short-circuit and I^2t status
600y42x02	H-bridge period length

600y42x03	H-bridge setpoint (0 ... 100 %)
600y42x06	Bridge x I^2t overcurrent value (0 ... 100 %) x= 1: H-bridge 1 x= 2: H-bridge 2
600y00261	H-bridge 1 Value 1: Set right side as digital output
600y00262	H-bridge 1 Value 1: Set left side as digital output
600y00263	H-bridge 2 Value 1: Set right side as digital output
600y00264	H-bridge 2 Value 1: Set left side as digital output

Analog/digital conversion

600y21x03	Analog Output Registers where x = 1 ... 4: Output 1 ... 4 Port : Connected to X119, X219
600y20x05	Mode selection Bit 0: 0 V ... +10 V in R 600y20x03 Bit 1: 0 V ... +32 V in R 600y20x03 Bit 2: 0 mA ... +20 mA in R 600y20x03 Bit 3: 4 mA ... +20 mA in R 600y20x03 Bit 4: Ratiometric voltage measurement: measured voltage / voltage supply x 1,000 where x = 1 ... 4: Output 1 ... 4
600y2210z	Current read back - digital output 1
600y2220z	Current read back - digital output 2
600y2230z	Current read back - digital output 3
600y2240z	Current read back - digital output 4
600y2250z	Current read back - digital output 5
600y2260z	Current read back - digital output 6
600y2270z	Current read back - digital output 7
600y2280z	Current read back - digital output 8
600y2290z	Current read back - H-bridge 1
600y2300z	Current read back - H-bridge 2
600y2310z	Voltage read back - analog output 1
600y2320z	Voltage read back - analog output 2
600y2330z	Voltage read back - analog output 3
600y2340z	Voltage read back - analog output 4
600y2350z	Battery voltage read back
where z = 3	Scaled value: Voltage in mV; (1,000 = 1 V)
where z = 4	Scaled value: Current in mA; (1,000 = 1 A)

Digital/analog conversion

Registers	Purpose
600y30x00	Status register für D/A output x Bit 0 = 0: D/A disabled Bit 0 = 1: D/A enabled
600y30x01	Command register für D/A output x Value 1: Enable D/A Value 2: Disable D/A
600y30x03	Setting the setpoint for D/A output x (0 ... 100 %)
600y30x05	Mode selection Bit 0: 0 ... 10 V Bit 1: 0 ... 32 V where x = 1 ... 4: Output 1 ... 4

EDS of I/O module

	Retrieving EDS data on the I/O module
600y99081	EDS page selection Value 0: Selecting page 0 Value 1: Selecting page 1
	Page 0
600y99082	Version of EDS page 0
600y99083	Module code
600y99084	Module name
600y99095	Hardware revision
600y99096	Hardware revision
600y99097	Minimum OS version required to match the given hardware
	Page 1
600y99082	Version of EDS page 1
600y99083	Serial number
600y99090	Production date: Day
600y99091	Production date: Month
600y99092	Production date: Year
600y99093	Assembly test number
600y99094	Assembly test revision

Appendix

Introduction

This appendix contains electrical and mechanical data, as well as operating data.

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A: JCM-350-E01/E02 - Pin assignment

Introduction

This chapter covers the pin assignment of all interfaces. It will give you an overview of all ports on the JCM-350-E01/E02.

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Connector X110 - Pin assignment

Interface

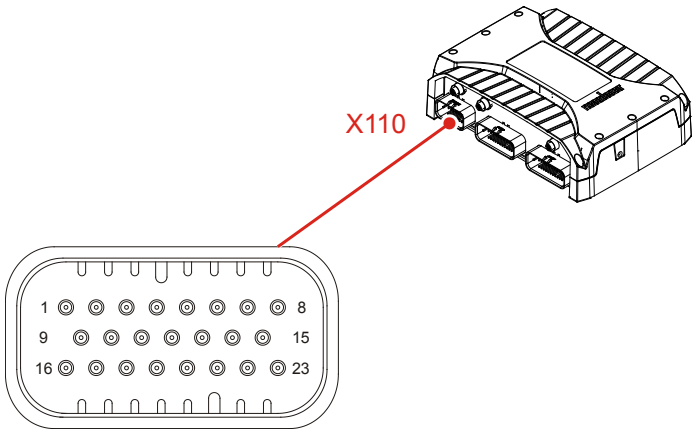
The pin assignment of connectors X110 and X210 is the same. The signals going through the pins of these two connectors are functionally independent of each other and are not interconnected. There is no complete electrical isolation.

Connector X110 features the following interfaces:

- Relay contacts # 101 ... 104
- Analog outputs # 103 ... 104
- Frequency/pulse inputs # 103 ... 104
- PWM outputs # 107 ... 108

Pin assignment

The diagram shows the pin assignment of connector X110:



Pin	Description
1	Relay 101: common contact
2	Relay 102: NC contact
3	Relay 102: NO contact
4	Relay 102: common contact
5	Relay 103: common contact
6	Relay 103: NC contact
7	Relay 104: NC contact
8	Relay 103: NO contact
9	Relay 101: NO contact
10	Analog output # 103
11	Analog output # 104
12	PWM output # 107
13	PWM output # 108
14	Relay 104: NO contact

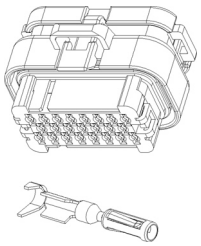
Pin	Description
15	Relay 104: common contact
16	Relay 101: NC contact
17	Reference potential
18	Power supply for external digital encoders short-circuit proof, thermal tripping in the case of overload
19	Frequency/pulse input 103
20	Frequency/pulse input 104
21	Unused
22	Unused
23	Unused

Connector specification

Type	AMPSEAL Automotive Plug Connector
Number of pins	23
Jetter item #	60874422
Name	BU_23_T_AMPSEAL_WI_RM4_SCHWARZ

Mating part of connector

Compatible mating part of 23-pin AMPSEAL connector:



Manufacturer	AMPSEAL
Item number - housing	770680-4
Item number - crimp contact (jack)	0-0770520-1
Diameter of the cable apt for connecting	0.75 mm² ... 1.5 mm² (AWG 20 ... 16)

Connector X118 - Pin assignment

Interfaces

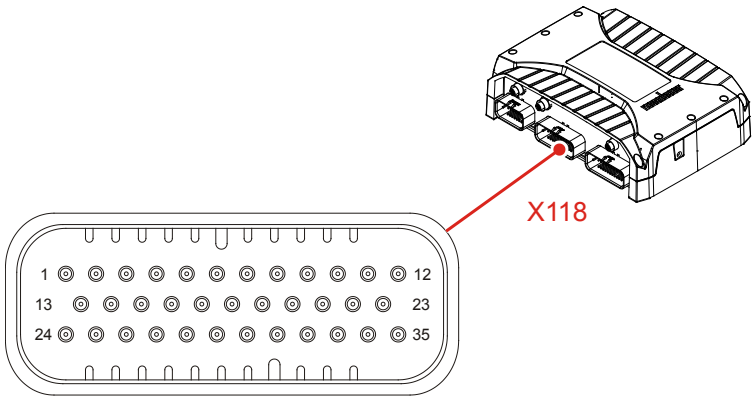
The pin assignment of connectors X118 and X218 is the same. The signals going through the pins of these two connectors are functionally independent of each other and are not interconnected. There is no complete electrical isolation.

Connector X118 features the following interfaces:

- Digital outputs # 105 ... 108
- Voltage supply for digital outputs # 105 ... 108
- Voltage supply for H-bridges # 101 ... 102
- H-bridge outputs # 101 ... 102
- Programmable digital active-high/active-low inputs # 104 ... 111
- PWM outputs # 105 ... 106
- Frequency inputs # 101 ... 102

Pin assignment

The diagram shows the pin assignment of connector X118:



Pin	Description
1	Digital output # 106, current-sourcing
2	Voltage supply for digital outputs # 105 ... 108
3	Voltage supply for digital outputs # 105 ... 108
4	Bridge output # 101, right
5	Bridge output # 101, left
6	Voltage supply for bridge # 101
7	Voltage supply for bridge # 101
8	Bridge output # 102, right
9	Bridge output # 102, left
10	Voltage supply for bridge # 102
11	Voltage supply for bridge # 102
12	Frequency input # 101
13	Digital output # 105, current-sourcing

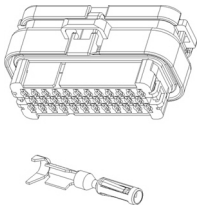
Pin	Description
14	Digital output # 108, current-sourcing
15	Bridge output # 101, right
16	Bridge output # 101, left
17	Reference potential
18	Reference potential
19	Bridge output # 102, right
20	Frequency input # 102
21	Bridge output # 102, left
22	Digital input 111
23	Digital input 110
4	Digital output # 107, current-sourcing
25	Digital input 104
26	Digital input 105
27	Digital input 106
28	Reference potential
29	Reference potential
30	Digital input 107
31	Digital input 108
32	Digital input 109
33	Not to be used (connector coding)
34	PWM output # 105
35	PWM output # 106

Connector specification

Type	AMPSEAL Automotive Plug Connector
Number of pins	35
Jetter item #	60874424
Name	BU_35_T_AMPSEAL_WI_RM4_ORANGE

Mating part of connector

Compatible mating part of 35-pin AMPSEAL connector:



Manufacturer	AMPSEAL
Item number - housing	776164-4
Item number - crimp contact (jack)	0-0770520-1
Diameter of the cable apt for connecting	0.75 mm² ... 1.5 mm² (AWG 20 ... 16)

Connector X119 - Pin assignment

Interfaces

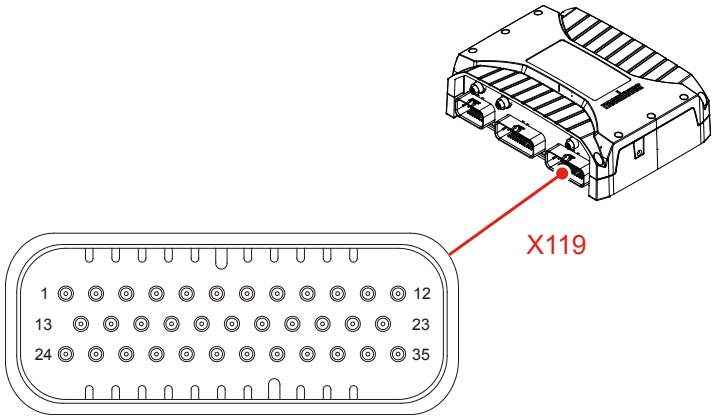
The pin assignment of connectors X119 and X219 is the same. The signals going through the pins of these two connectors are functionally independent of each other and are not interconnected. There is no complete electrical isolation.

Connector X119 features the following interfaces:

- Analog inputs # 101 ... 104
- Digital pull-down inputs # 101 ... 103
- Digital outputs # 101 ... 104
- CAN interfaces # 4 and 5
- PWM outputs # 101 ... 104
- Voltage supply for digital outputs # 101 ... 104
- Voltage supply for digital inputs
- Voltage supply for analog inputs
- Voltage supply for PWM outputs

Pin assignment

The diagram shows the pin assignment of connector X119:



Pin	Description
1	Analog input # 104
2	Analog input # 103
3	Digital input 103
4	Digital input 102
5	Digital input 101
6	Digital output # 102, current-sourcing
7	Digital output # 104, current-sourcing
8	Digital output # 101, current-sourcing
9	Digital output # 103, current-sourcing
10	Voltage supply for digital outputs # 101 ... 104
11	Voltage supply for digital outputs # 101 ... 104

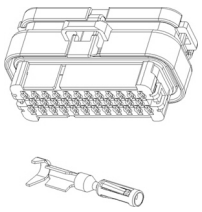
Pin	Description
12	Voltage supply for electronic circuits
13	Analog input # 102
14	Analog input # 101
15	Analog output # 101
16	Analog output # 102
17	Reference potential
18	Reference potential
19	Voltage supply for analog outputs
20	Reference potential
21	Voltage supply for PWM outputs
22	Voltage supply for analog inputs
23	Voltage supply for digital inputs
24	PWM output # 101
25	PWM output # 102
26	PWM output # 103
27	PWM output # 104
28	Reference potential
29	Reference potential
30	CAN-L CAN interface # 5
31	Sensor power supply for analog peripheral devices
32	CAN-L CAN interface # 4
33	Do not connect
34	CAN-H CAN interface # 4
35	CAN-H CAN interface # 5

Connector specification

Type	AMPSEAL Automotive Plug Connector
Number of pins	35
Jetter item #	60874423
Name	BU_35_T_AMPSEAL_WI_RM4_SCHWARZ

Mating part of connector

Compatible mating part of 35-pin AMPSEAL connector:



Manufacturer	AMPSEAL
Item number - housing	776164-4
Item number - crimp contact (jack)	0-0770520-1
Diameter of the cable apt for connecting	0.75 mm² ... 1.5 mm² (AWG 20 ... 16)

Connector X210 - Pin assignment

Interfaces

Only JCM-350-**E02**-xxx is equipped with connector X210.

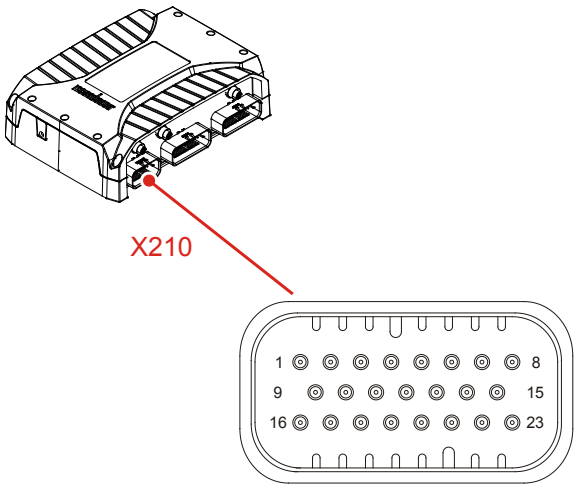
The pin assignment of connectors X110 and X210 is the same. The signals going through the pins of these two connectors are functionally independent of each other and are not interconnected. There is no complete electrical isolation.

Connector X210 features the following interfaces:

- Relay contacts # 201 ... 204
- Analog outputs 203 ... 204
- Frequency/pulse inputs # 202 ... 203
- PWM outputs # 207 ... 208

Pin assignment

The diagram shows the pin assignment of connector X210:



Pin	Description
1	Relay 201: common contact
2	Relay 202: NC contact
3	Relay 202: NO contact
4	Relay 202: common contact
5	Relay 203: common contact
6	Relay 203: NC contact
7	Relay 204: NC contact
8	Relay 203: NO contact
9	Relay 201: NO contact
10	Analog output # 203
11	Analog output # 204
12	PWM output # 207
13	PWM output # 208

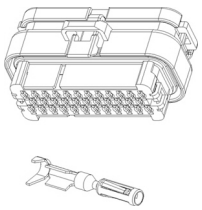
Pin	Description
14	Relay 204: NO contact
15	Relay 204: common contact
16	Relay 201: NC contact
17	Reference potential
18	Power supply for external digital encoders short-circuit proof, thermal tripping
19	Frequency/pulse input 203
20	Frequency/pulse input 204
21	Unused
22	Unused
23	Unused

Connector specification

Type	AMPSEAL Automotive Plug Connector
Number of pins	23
Jetter item #	60874422
Name	BU_23_T_AMPSEAL_WI_RM4_SCHWARZ

Mating part of connector

Compatible mating part of 35-pin AMPSEAL connector:



Manufacturer	AMPSEAL
Item number - housing	776164-4
Item number - crimp contact (jack)	0-0770520-1
Diameter of the cable apt for connecting	0.75 mm² ... 1.5 mm² (AWG 20 ... 16)

Connector X218 - Pin assignment

Interfaces

Only JCM-350-**E02**-xxx is equipped with connector X218.

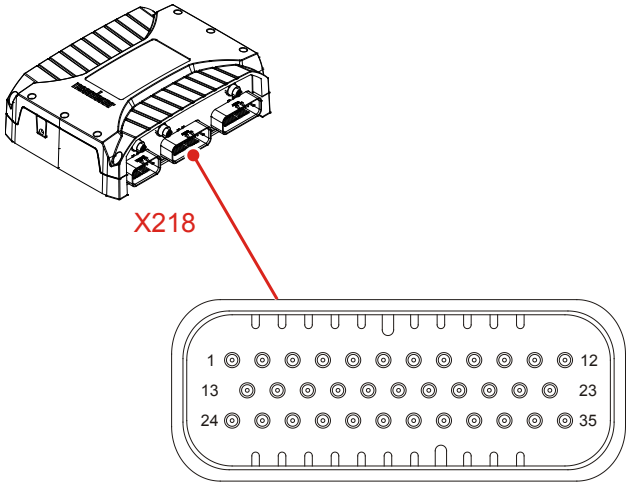
The pin assignment of connectors X118 and X218 is the same. The signals going through the pins of these two connectors are functionally independent of each other and are not interconnected. There is no complete electrical isolation.

Connector X218 features the following interfaces:

- Digital outputs # 205 ... 208
- Voltage supply for digital outputs # 205 ... 208
- Voltage supply for H-bridges # 201 ... 202
- H-bridge outputs # 201 ... 202
- Programmable digital active-high/active-low inputs # 204 ... 211
- PWM outputs # 205 ... 206
- Frequency Inputs 200 and 201

Pin assignment

The diagram shows the pin assignment of connector X218:



Pin	Description
1	Digital output # 206, current-sourcing
2	Voltage supply for digital outputs # 205 ... 208
3	Voltage supply for digital outputs # 205 ... 208
4	Bridge output # 201, right
5	Bridge output # 201, left
6	Voltage supply for bridge # 201
7	Voltage supply for bridge # 201
8	Bridge output # 202, right
9	Bridge output # 202, left
10	Voltage supply for bridge # 202
11	Voltage supply for bridge # 202

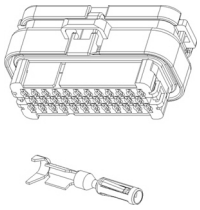
Pin	Description
12	Frequency input # 201
13	Digital output # 205, current-sourcing
14	Digital output # 208, current-sourcing
15	Bridge output # 201, right
16	Bridge output # 201, left
17	Reference potential
18	Reference potential
19	Bridge output # 202, right
20	Frequency input # 202
21	Bridge output # 202, left
22	Digital input 211
23	Digital input 210
24	Digital output # 207, current-sourcing
25	Digital input 204
26	Digital input 205
27	Digital input 206
28	Reference potential
29	Reference potential
30	Digital input 207
31	Digital input 208
32	Digital input 209
33	Not to be used (connector coding)
34	PWM output # 205
35	PWM output # 206

Connector specification

Type	AMPSEAL Automotive Plug Connector
Number of pins	35
Jetter item #	60874424
Name	BU_35_T_AMPSEAL_WI_RM4_ORANGE

Mating part of connector

Compatible mating part of 35-pin AMPSEAL connector:



Manufacturer	AMPSEAL
Item number - housing	776164-4
Item number - crimp contact (jack)	0-0770520-1
Diameter of the cable apt for connecting	0.75 mm² ... 1.5 mm² (AWG 20 ... 16)

Connector X219 - Pin assignment

Interfaces

Only JCM-350-**E02**-xxx is equipped with connector X219.

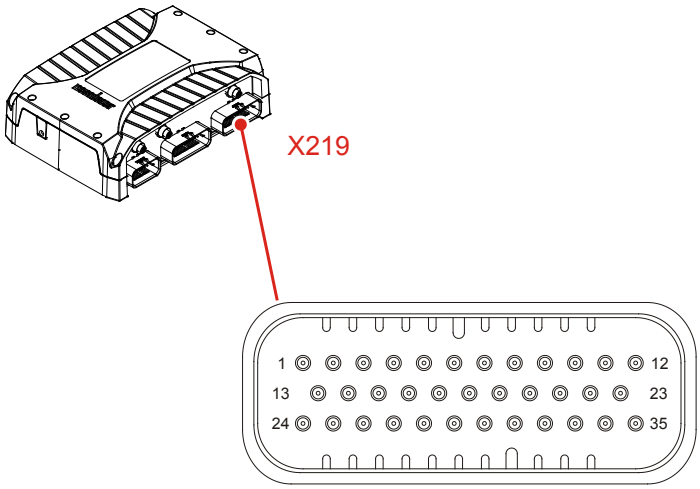
The pin assignment of connectors X119 and X219 is the same. The signals going through the pins of these two connectors are functionally independent of each other and are not interconnected. There is no electrical isolation.

Connector X219 features the following interfaces:

- Analog inputs # 201 ... 204
- Digital pull-down inputs # 201 ... 203
- Digital outputs # 201 ... 204
- CAN interfaces # 4 and 5 are present; not interconnected
- PWM outputs # 201 ... 204
- Voltage supply for digital outputs # 201 ... 204
- Voltage supply for digital inputs
- Voltage supply for analog inputs
- Voltage supply for PWM outputs

Pin assignment

The diagram shows the pin assignment of connector X219:



Pin	Description
1	Analog input # 204
2	Analog input # 203
3	Digital input 203
4	Digital input 202
5	Digital input 201
6	Digital output # 202, current-sourcing
7	Digital output # 204, current-sourcing
8	Digital output # 201, current-sourcing
9	Digital output # 203, current-sourcing
10	Voltage supply for digital outputs # 201 ... 204

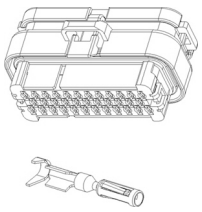
Pin	Description
11	Voltage supply for digital outputs # 201 ... 204
12	Voltage supply for electronic circuits
13	Analog input # 202
14	Analog input # 201
15	Analog output # 201
16	Analog output # 202
17	Reference potential
18	Reference potential
19	Voltage supply for analog outputs
20	Reference potential
21	Voltage supply for PWM outputs
22	Voltage supply for analog inputs
23	Voltage supply for digital inputs
24	PWM output # 201
25	PWM output # 202
26	PWM output # 203
27	PWM output # 204
28	Reference potential
29	Reference potential
30	Not interconnected
31	Sensor power supply for analog peripheral devices
32	Not interconnected
33	Do not connect
34	Not interconnected
35	Not interconnected

Connector specification

Type	AMPSEAL Automotive Plug Connector
Number of pins	35
Jetter item #	60874423
Name	BU_35_T_AMPSEAL_WI_RM4_SCHWARZ

Mating part of connector

Compatible mating part of 35-pin AMPSEAL connector:



Manufacturer	AMPSEAL
Item number - housing	776164-4
Item number - crimp contact (jack)	0-0770520-1
Diameter of the cable apt for connecting	0.75 mm² ... 1.5 mm² (AWG 20 ... 16)

B: Technical Data

Introduction

This section of the appendix contains both electrical and mechanical data, as well as operating data of the JCM-350-E01/E02 module.

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Technical specifications

Analog inputs - Technical specifications

Parameter	Description
Configurable output voltage range	DC 0 V ... DC 10 V, maximum supply voltage for analog outputs DC 0 V ... DC 32 V, maximum supply voltage for analog outputs
Maximum output current	100 mA
Accuracy related to ultimate voltage value	99 %

Analog inputs - Technical specifications

Parameter	Description
Maximum input voltage for voltage measurements	+32 V
Maximum input current for current measurements	22.5 mA (+9 V)
Resolution	12 bits
Accuracy	99.5 %
Input frequency	50 Hz
Limit frequency of 10 V range	250 Hz, 3 dB attenuation of input signal, Input impedance: 43 kΩ
Limit frequency of 32 V range	660 Hz, 3 dB attenuation of input signal, Input impedance: 35 kΩ
Input impedance (voltage)	35 kΩ / 43 kΩ
Input impedance (current)	400 Ω

Digital outputs - Technical specifications

Parameter	Description
Maximum rated current per output	8 A
Total current for outputs 101 ... 104	16 A
Total current for outputs 105 ... 108	16 A
Total current for outputs 201 ... 204	16 A
Total current for outputs 205 ... 208	16 A
Switching frequency	100 Hz
Allowed overload current per output during power-up	40 A for 500 ms
Allowed overload current per output during power-up	16 A for 4 s
Minimum voltage per output; dependent on the supply voltage for digital outputs	7.0 V
Maximum voltage per output; dependent on the supply voltage for digital outputs	32 V

Digital Inputs - Technical Data

Parameter	Description
Type of inputs	Active-high or active-low input (programmable)
Permissible voltage range	DC 7.5 V ... DC 32 V
Typical threshold level OFF	Active-high: < 0.3 x supply voltage of digital inputs Active-low: > 0.7 x supply voltage of digital inputs
Typical threshold level ON	Active-high: > 0.7 x supply voltage of digital inputs Active-low: < 0.3 x supply voltage of digital inputs
Typical input resistance	3.2 kΩ
Typical input current (U = 24 V)	7.5 mA
Maximum input frequency	50 Hz

Frequency/pulse inputs - Technical specifications

Parameter	Description
Type of inputs	Active-low inputs with pull-down resistor
Permissible voltage range	DC 0 V ... DC 32 V
Threshold level OFF	■ < 0.3 x supply voltage of digital inputs for JCM-350-Exx-G05 ■ < 0.2 x supply voltage of digital inputs for JCM-350-Exx-G12
Threshold level ON	■ > 0.7 x supply voltage of digital inputs for JCM-350-Exx-G05 ■ > 0.3 x supply voltage of digital inputs for JCM-350-Exx-G12
Typical input resistance	3.2 kΩ
Typical input current	7.5 mA
Maximum input frequency	50 kHz

H-bridges 1/2 - Technical specifications

Parameter	Description
Voltage supply of outputs	0.3 V
Overload behavior	80 A for 500 ms 32 A for 4 s
Current measurement, resolution	12 bits
Accuracy related to twice the rated current	95 %
Switching frequency (1/period length)	100 Hz ... 4 kHz
Frequency accuracy	100 ppm
Resolution of pulse control factor	20 ns

High-current relay - Technical specifications

Parameter	Description
Relay type 101, 102, 201, 202	Minirelais K (Infineon)
Contact	1 x UM
Permissible voltage range	DC 5 V ... DC 32 V
Permissible current	0.5 A ... 15 A

Standard relay - Technical specifications

Parameter	Description
Relay type 103, 104, 203, 204	Cp1 Relay (Nais)
Contact	1 x UM
Permissible voltage range	DC 5 V ... DC 32 V
Permissible current	0.5 A ... 2 A

In the case of inductive loads, install an appropriate contact protection (free-wheeling diode, spark suppressor).

PWM outputs - Technical specifications

Parameter	Description
Type of outputs	High-side
Nominal current of individual outputs	2 A
Typical output voltage at nominal current	Power supply PWM -200
Overload protection at power-up	10 A for 500 ms 4 A for 4 s
Total current of all 8 PWM outputs	8 A
Clock frequency	25 Hz ... 1 KHz Can be configured in steps of 25 Hz
Frequency accuracy	95 %
Resolution of pulse control factor	20.083 ns
Accuracy of pulse control factor	±2 µs
Switch-on frequency under overload conditions	Depending on thermal overall condition
Switch-on frequency without overload	No restriction
Load	Resistive, inductive, lamps
Protective circuitry	Capacitive, free-wheeling diode
Diagnostic functions	Overload, short circuit

Power supply of analog inputs - Technical data

The following information applies only to JCM-350-**G05**:

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Peak current	1 A
Connecting pins	X119.22/X219.22

Power supply of analog output - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Corresponds to the total output power of all analog outputs
Maximum input current	400 mA
Connecting pins	X119.19/X219.19

Power supply of H-bridge 1 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current	Total output current - H-bridge 1
Maximum output current	16 A
Connecting pins	X118.6, X118.7/ X218.6, X218.7

Power supply of digital inputs - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current (at 24 V power supply)	150 mA
Connecting pins	X119.23/X219.23

Power supply of digital outputs 1 ... 4 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Current consumption	Sum of output currents of digital outputs 1 ... 4
Connecting pins	X119.10, X119.11/ X219.10, X219.11

Power supply of digital outputs 5 ... 8 - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Current consumption	Sum of output currents of digital outputs 5 ... 8
Connecting pins	X118.2, X118.3/ X218.2, X218.3

Power supply of PWM outputs - Technical specifications

Parameter	Description
Permissible voltage range	DC 7.5 V ... DC 32 V
Input current (at PWM power supply = 24 V)	Corresponds to the total output power of all PWM outputs
Maximum total output current of all PWM outputs	8 A
Connecting pins	X119.21/X219.21

Power supply UC_UBAT - Technical specifications

Parameter	Description
Operating voltage - device	DC 7 V ... 32 V
Operating voltage - controller	≥ DC 5.5 V
Typical input current (at 24 V power supply)	200 mA + encoder supply (only for **G12** models)
Connecting pins	X119.12/X219.12

Memory - Technical Data

Parameter	Description
Flash	16 MB
SDRAM	16 MB
FRAM (remanent)	32 kB

CAN interface - Technical specifications

Parameter	Description
Baud rates	250 kBaud
Bus termination	None
External termination recommended	120 Ω

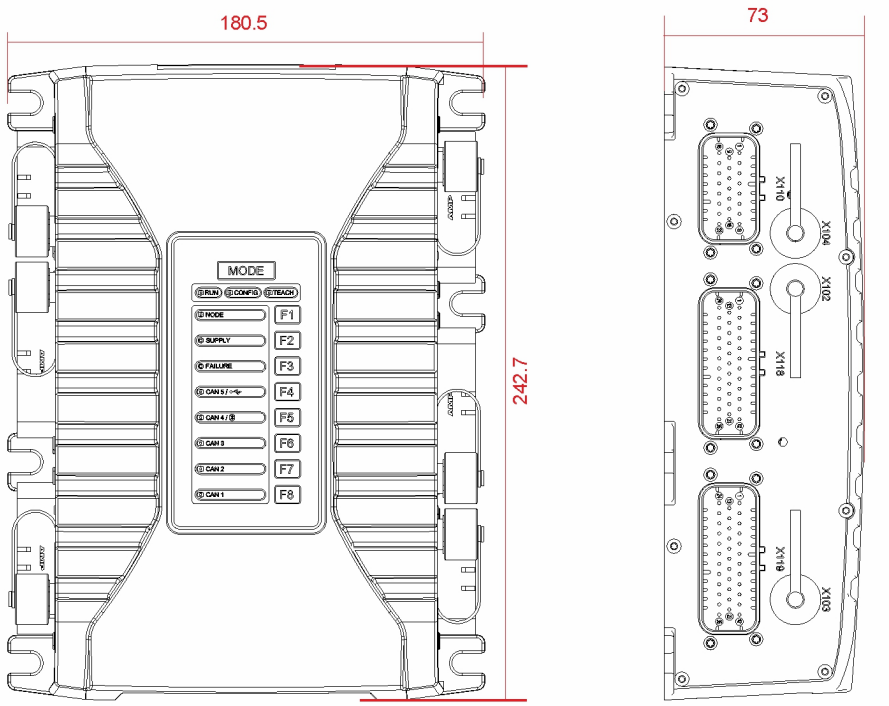
Physical dimensions

Introduction

This chapter details the physical dimensions of the JCM-350-E01/E02 and the conditions for its installation. This device is available from Jetter AG in two different housing designs: G05 or G12.

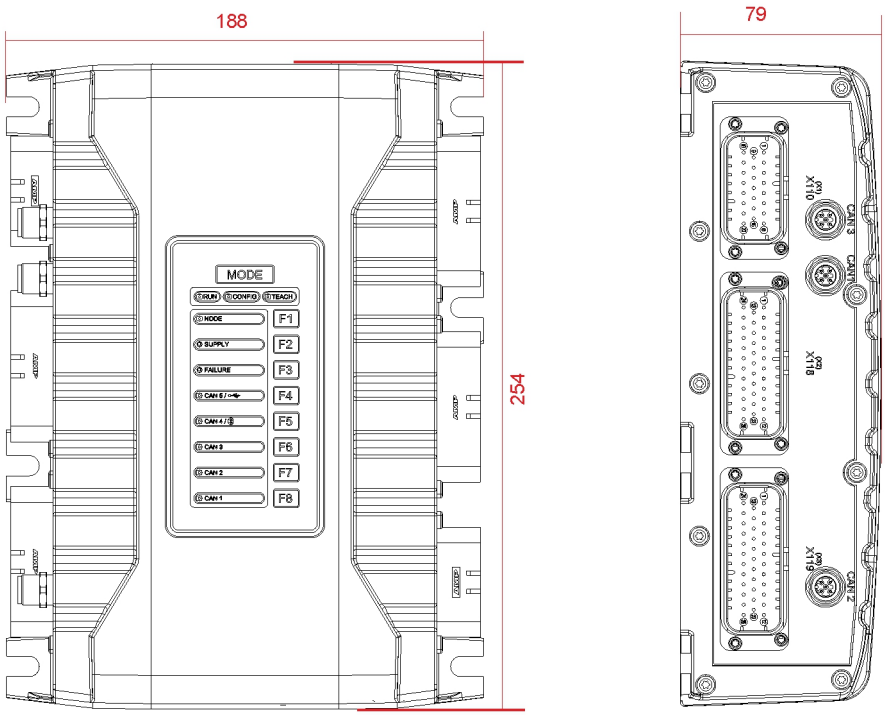
Model G05

The illustration below shows the dimensions of the model G05:



Model G12

The illustration below shows the dimensions of the model G12:



Protection against overheating

When you select a place for installing the JCM-350-E01/E02, consider the following facts:

- The JCM-350-E01/E02 increases the temperature of the environment as a result of heat emission under load.
- The JCM-350-E01/E02 design enables excess heat to be dissipated via base plate. Ensure an unobstructed heat conduction.

Consider the heat emission from the JCM-350-E01/E02, in particular when installing it in a critical environment:

- In the vicinity of the fuel tank
- In the vicinity of the fuel pipe
- In the vicinity of flammable vehicle components
- In the vicinity of thermally malleable vehicle components

Space required for installation and service

When you select a place for installing the JCM-350-E01/E02, consider the following facts:

- Ensure there is enough space around the connector for servicing requirements. It should be possible to disconnect the connector at any time.
- Ensure there is enough space around the operator interface for servicing requirements. The operator interface must be visible and accessible.

Operating parameters - Environment and mechanics

Environment

Parameter	Value	Standard
Operating temperature range	-20 ... +85 °C	
Storage temperature range	-40 ... +110°C	
Air humidity	10 ... 95 %, Non-condensing	DIN EN 61131-2
Humid heat, cyclic		To DIN EN 60068-2-30
Corrosion / chemical resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapors, or other corrosive or electroconductive contaminants	

Mechanical Parameters

Parameter	Value	Standard
Vibration resistance	Vibration, broadband noise (severity level 2)	DIN EN 60068-6 and DIN EN 60068-34
Shock resistance	Tested in all 3 directions; Amplitude of shock: 30 g half-sine, 18 ms duration	DIN EN 60068-2-27
Degree of protection	IP20	DIN EN 60529

Operating Parameters - EMC

EMC - Emitted interference

This device has been checked as per Directive 72/245/EEC with all amendments up to 2009/19/EC and meets all test criteria.

Parameter	Value	Standard
Emitted interference	Requirements of Appendix 6 and 7 are met	Directive 72/245/EEC with all amendments including 2009/19/EC
Anechoic chamber / electromagnetic fields	Fulfilled	ISO 11452-2

EMC - immunity to interference

Parameter	Value	Standard
Interference immunity to conducted faults	Fulfilled	Directive 72/245/EEC with all amendments including 2009/19/EC
Interference immunity to external magnetic field	20 ... 2,000 MHz: Irradiation up to 100 V/m	Directive 72/245/EEC with all amendments including 2009/19/EC
Electrostatical Discharge	Severity level 2	ISO 10605
Electromagnetic disturbance caused by power and coupling	Type of test pulses: 1, 2a, 2b, 3a, 3b, 4	ISO 7637-2
Anechoic chamber / electromagnetic fields	Fulfilled	ISO 11452-2
Load dump	Pulse 5b 120 V with 4 Ω	ISO 7637-2

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